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## CENTRALIZATION OF POWER GENERATION.

The paper read by Mr. Samuel Insull before the meeting of the American Institute of Electrical Engineers last week has brought prominently to the attention of the electrical engineers of the country a tendency which has for some time been manifest and which has been actively furthered in a very practical manner by the Commonwealth Edison Company, of Chicago. This company has set the example of not only connecting to its lines all of the lighting and power load which can be induced to use its service, but also in serving the electric railways of that city by furnishing a considerable fraction of the energy used by them. This energy represents the excess required over and above the ability of the power plants operated by the electric railways themselves to furnish. The extension of this policy is seen in the offer to supply power for operating the steam-railroad terminals in Chicago under the plan which is now being worked out to electrify them. It seems probable that when this is done the power will be furnished by the Commonwealth Edison Company, and there will be no such duplication of power-generating stations as has been in evidence in other schemes of railroad electrification.

The carrying out of this policy of centralization not only means a decrease in the cost of power, due to the possibility of larger generating units and to the diversity introduced by connecting different loads to the same central station, but it is also of importance from the viewpoint of the conservationists. Mr. Insull has pointed out what an enormous saving in coal would be represented by the elimination of a large number of small and inefficient generating stations.

Just what limitations will be set in practice to the carrying out of this policy of centralization remains to be seen. The advantages of large units, of diversity in the load, and the utilization of the skill and knowledge of a number of the highest engineering experts all begin to lose weight after a system has reached a certain large, although rather indefinite size. After such a point is reached, especially if an extension of territory must be involved in further expansion, the question of the cost of transmission and continuity of service will have considerable weight in limiting further expansion in service and centralization in generation. The subject is one, nevertheless, which opens up great possibilities both to the engineer and to those more deeply interested in the financial aspects of power supply. With the impetus given to the consideration of this matter by Mr. Insull's address, we may expect to see considerable atten-

tion devoted to the subject in the near future, and a realization, at least to a partial extent and in the more congested districts, of the policies advocated.

## REGULATION OF PUBLIC UTILITIES IN WISCONSIN.

A summary of the fifth annual report of the Wisconsin Railroad Commission is given in this issue. From it may be learned some of the work of this Commission and the results of its activities along the line of regulation of public utilities in that State.

The regulation of public utilities is usually looked upon as a movement intended to secure reasonable rates and good service to the consumer and as instituted for the sole purpose of benefiting him. In many cases the managements of public utilities have strongly opposed the establishment of such a commission for their regulation. That this attitude is a mistaken one is very evident from a consideration of the results which have been attained in Wisconsin. While it is true that the Commission has in that State secured better service for the customers of many utilities, and has in certain cases reduced the rates, it is also true that it has greatly improved conditions from the standpoint of the investor. The utilities of Wisconsin are no longer confronted with the periodic occurrence of franchise expirations and the necessity for great effort and expense to insure their extension; neither is there any longer occasion to lobby at the State Capitol to secure the passage or defeat of legislation applying to them. The indeterminate franchises, the prohibition against the establishment of competing utilities where there is no necessity for them, which prohibition has now been extended to include telephone companies, and the greater stability which adheres to the securities of this class of corporation are all in favor of the owners of the public utilities. That the financial conditions from the standpoint of the operators and investors is satisfactory is evident from the fact that while during the past year the plant value of all the utilities increased 10 per cent, the gross revenues increased over 13 per cent and the net earnings 14 per cent. Considering the electric light and power stations alone, the net earnings have increased 24.3 per cent, whereas the plant value has increased only 22.1 per cent, showing a greater increase in earnings than in investment. In this case, however, the net earnings have not increased as rapidly as the gross revenue, for which the figure is 26.7 per cent. It may be noted in this connection that the value of electric central stations constitutes one-third of the total value of all utilities.

These results have been achieved in Wisconsin under conditions which are no doubt much more favorable than exist in some other states. While the Wisconsin public-utility law is considered by some a model for such legislation, there are others who think it could be improved. It must at least be regarded as highly satisfactory. In the constitution of its commission, however, Wisconsin can lay claim to conditions which are hardly to be expected in some localities. Appointments to this commission have been made solely with respect to the qualifications of the commissioners, and political considerations have been largely absent. It is to be regretted that in some states this has not been the case, with the result that the regulation of the public-utility companies has not been so satisfactory, and naturally the utility corporations in many states fear the enactment of a law giving powers of regulation to a commission on account of the liability of the appointment on the commission of men unqualified to carry out their duties in the most effective and equitable way. Perhaps the first step to be taken in states where such conditions exist is to secure the independence of such administration by its removal from the domain of practical politics, as has been so effectively done in Wisconsin. It is to be noted that the best conditions in this country exist in those states where the greatest progress has been made in legislation to exclude the political machine from the domination of the state government. When this achievement is first accomplished, utilities need have no fear of injury to their legitimate interests from the establishment of regulating commissions under adequate public-utility acts.

## PROPOSED CHANGES IN RULE 15 OF THE NATIONAL CODE.

The real position and importance in the electrical and industrial field of the little volume of wiring and installation rules known as the National Electrical Code is not always fully appreciated even by electricians themselves. Its origin may be said to be due to the desire on the part of insurance companies to prevent electric wiring of a character such as to introduce a fire hazard in premises favored with electric service, and originally its so-called rules were but recommendations. In fact, they profess to be nothing else now; but they have been so wisely formulated and are so promptly modified to meet changing conditions that they are now really little less than absolute laws governing electric wiring practice the country over, and have been legally adopted in some places. And these rules should generally be absolute laws. They represent the best judgment and experience of a body of electrical specialists sufficiently large and chosen from sections of the electrical field sufficiently varied to enable this body to view electric wiring from every necessary standpoint. Thus it happens that strict observance of Code rules reduces the electrical fire hazard to a quantity which is but little more than merely nominal. Moreover, although it is not generally admitted by the men charged with the revision of the Code, the life hazard has been a powerful element in shaping many of its rules. A specific instance of this sort is seen in Rule 15, which, it will be recalled, relates to the grounding

of low-potential circuits. This matter has received its full measure of discussion in the past, and the majority of opinion seems to have been that so far as any fire risk is concerned grounding is not undesirable; but the belief that an unwarranted life hazard might be thus introduced was for a long time the apparent cause of failure to insert in the Code a specific requirement for the grounding of low-potential circuits. It is interesting to note, therefore, that the Electrical Committee of the National Fire Protection Association at its recent meeting in Boston recommended that Section *a* of Rule 15 be changed so as to require the grounding of the neutral of the three-wire system, instead of only suggesting the desirability of it, as the rule referred to now does. Moreover, Section *b* of the same rule is to be changed so as to require specifically the grounding of transformer secondaries also where the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts. Also, the succeeding clause of the rule is to be modified so as to permit the grounding even when the voltage just mentioned is exceeded. The action of the Committee would seem to be altogether timely. As stated in last week's issue, the foregoing changes are not to become immediately mandatory; but that they will soon become so there seems to be no doubt.

## THE DICK PATENT DECISION.

We called attention in these columns in the issue of March 16 to the decision handed down that week by the United States Supreme Court in the case brought by the A. B. Dick Company against Sidney Henry, involving the patent on an accessory to the rotary mimeograph. In that decision the Supreme Court gave its sanction to the contention that the selling of an article to be used with a patented device in violation of a license agreement constitutes in itself an infringement of a patent. On account of the wide-reaching influence of this decision, the Attorney-General of the United States petitioned for a rehearing and asked that the Government be made a party to the case, on account of the wide interest of the people in the principle involved. On April 8 the Supreme Court announced its refusal of the rehearing and the decision must consequently stand. This denial was in spite of the fact that the original opinion was concurred in by only four members of the Court, which is less than a majority of the full bench, although it has been a custom that cases involving principles of such widespread importance would be decided only when a majority of the entire court concurred.

The circumstances of the case were as follows. The A. B. Dick Company is the manufacturer of the rotary mimeograph, upon which the fundamental patents have expired, but which is still covered by a later patent relating to the invention of a movable stop which is used on the machine. The mimeograph has lettered upon it a license condition that it is only to be used with paper, ink and other materials supplied by the owner of the patent. The defendant sold to the user of one of the plaintiff's machines a bottle of ink to which was attached a small label providing that it was not to be used in violation of this patent. It was proven in the lower court that the seller of this ink was aware that it was intended to be used upon the Dick mimeograph, and although the ink was never so used, the court decided that the patent was infringed by the mere sale of the ink with this knowledge.

Since the law establishing the patent monopoly grants to the patentee the exclusive right to make, use and vend his invention, the extension of his monopoly by bringing under the patent law any contract of sale which he may choose to make in the guise of a license agreement, either expressed or merely implied, appears to be an example of judicial legislation, since evidently the intention of the framers of the patent law did not cover any such contingency, and it is not expressed in the law itself. Indeed this extension of the rights conferred by a patent is in contradiction to previous expressions by the Supreme Court itself, as pointed out in the dissenting opinion of Chief Justice White. The precedents which seem to authorize it existed only in decisions of the lower courts, which could hardly seem to be binding upon the Supreme Court in view of their disagreement with its own previous decisions. However, the only relief from the condition presented by this decision seems now to rest in further legislation by Congress. It has entire jurisdiction over the matter. The Constitution merely gives Congress the right to legislate upon the subject and does not limit Congress in any way, not even requiring that patents shall be issued at all.

While it would have no bearing upon the decision of the main principle involved, it would seem that this case should perhaps upon its own merits have been thrown out on account of an entirely different consideration, namely, the validity of the patent itself. It will be noted that the controlling patent was merely upon a very minor improvement to the original machine, which might have been made by anyone with a requisite mechanical knowledge for designing and manufacturing a similar class of machines. In the case of the Hall transformer patent recently decided, a reference to which will be found in our LEGAL NOTES this week, the court decided that such an improvement, which would naturally be worked out by anyone with ordinary engineering skill and mechanical ability, does not constitute a patentable invention. Both this fact and the extension of rights under the patent law to cover implied license agreements consisting merely of an ordinary contract, upon the basis of precedents in a lower court in opposition to previous decisions of the Supreme Court of the United States itself, render this decision very remarkable as well as a very important and far-reaching one.

## Joint Meeting of Architects and Illuminating Engineers.

On Thursday, May 2, a joint meeting of the New York Chapter of the American Institute of Architects and the New York Section of the Illuminating Engineering Society will be held. A paper will be presented by Henry Hornbostel and Bassett Jones, Jr., entitled "The Relation of Light to Shadow and Color in Design." The paper will be illustrated by models and color booths. All persons interested in the subject are invited to attend, and copies of the paper may be obtained in advance by applying to A. J. Marshall, 16 East Fortieth Street. New York City, The meeting will be held in the building of the United Engineering Societies, 29 West Thirty-Ninth Street, at 8:15 p. m. Prior to the meeting an informal dinner will be held at 6 p. m. at Keen's Chop House, 70 West Thirty-Sixth Street, at which ladies will be present.

## Electrical Exports for February.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has completed its monthly summary of the imports and exports of the United States for the month of February, 1912. From these statistics the following data relative to the electrical exports have been obtained.

The electrical figures for February show a decided improvement over those of a year ago, particularly as to machinery exports. Compared to the preceding month, however, the electrical-appliance total of February is somewhat disappointing. A comparative summary follows:

| Month | Electrical Appliances | Electrical Machinery | Total Electrical Exports |
|---|---|---|---|
| Feb., 1912 | $ 968,626 | $672,676 | $1,641,302 |
| Feb., 1911 | 939,714 | 551,885 | 1,491,599 |
| Jan., 1912 | 1,045,636 | 675,633 | 1,721,269 |

A list of the principal countries to which electrical shipments were made and the value of these exports is given below.

| Countries | Electrical Appliances | Electrical Machinery |
|---|---|---|
| United Kingdom | $ 58,879 | $ 30,523 |
| Canada | 313,937 | 109,889 |
| Mexico | 77,410 | 79,379 |
| Cuba | 40,766 | 29,212 |
| Brazil | 188,196 | 143,728 |
| Japan | 45,689 | 113,983 |

## Wireless Treaty Ratified.

The United States Senate on April 3 ratified the International Wireless Convention providing for the control of wireless service between ships and shore stations. This convention was signed at Berlin in November, 1906, and was sent to the Senate about a year later by President Roosevelt. Owing to opposition of the commercial companies it had never previously been approved by the Senate, although strongly advocated by the Navy Department. The convention has been signed by 28 nations.

## Receivers Take Allis-Chalmers.

Receivers were appointed on April 6 for Allis-Chalmers Company by Judge Sanborn of the United States District court. The receivers are D. W. Call, president of the company, and Otto H. Falk, president of the Merchants and Manufacturers' Association of Milwaukee.

The appointments were made on the application of the First National and Wisconsin National banks, both creditors of the company, and W. W. Nichols of New York, a bond and stock holder.

While no statement to that effect could be obtained, the proceeding probably is intended to facilitate the early reorganization of the company. The court directed the receivers to continue the business of the company so that all its assets and interests as a going concern will be fully protected.

The present capitalization of the Allis-Chalmers Company consists of $15,000,000 bonds, of which $11,148,000 are outstanding; preferred stock, $25,000,000, of which $16,150,000 is outstanding; and common stock, $25,000,000, of which $19,820,000 is outstanding.

## Electric-Vehicle Show in Louisville.

The Louisville Electric Dealers' Association, composed of automobile concerns which sell electrics, has been organized, and is planning the holding of a show confined exclusively to electric cars. It will probably take place at the First Regiment Armory in the fall. E. G. Reimers is president of the association, Lee Miles is vice-president and Carl Reimers is secretary and treasurer. A feature of the work has been the adoption of a uniform agreement whereby the garages assume no responsibility for damages to cars from fires or other accidents. They are named as the servants of the owners, whose insurance policies are thus extended to cover them while in the garages. The association has also adopted a uniform scale of rates for charging electric cars, and this is being adhered to generally.

## Demand for Telephone Wire.

In the five years covered by the last census of the telephone industry there were added about 8,000,000 miles of wire to the telephone systems in this country.

## Mining Convention.

The fifteenth annual convention of the American Mining Cogress will be held at Spokane, Wash., probably during the week beginning November 18.

## Electricity Direct From Coal.

At the opening of the Smoke Abatement Exhibition in London, on March 23, Sir William Ramsay referred to the ideal state of things that would exist if we had gas retorts in the bowels of the earth, adding that there was nothing so far as he could see to prevent a bore-hole from being put down until the coal substratum was reached, concentric tubes being used to set the coal on fire by electricity. Air would be blown down to enable the coal to burn as a preliminary operation.

Sir William elaborated his idea thus: "When sufficient heat has been engendered, the amount of air sent down can be restricted. Coal with plenty of air gives carbon dioxide. When partially burned it gives carbon monoxide, which is used for gas engines. If steam were blown in, it would give a mixture of hydrogen and carbonic oxide, or water gas, which also is frequently used in gas engines. Bring your gas engines to the mouth of your pit or bore-hole, and produce your power there. You would thus save thirty per cent of the energy of the coal available as against fifteen per cent available in fuel engines. That energy might be transformed into electricity at the mouth of the bore-hole and you could distribute it through the country, wherever you liked. In this way you would get electricity available for lighting and heating, your railways would be worked by electricity, and the only fuel you would require would be oil for ships."

## Pittsburgh Boosters Elect Officers.

The monthly meeting of the Pittsburgh Electric Boosters was held in the Seventh Avenue Hotel on Monday evening, April 1. Henry Harris, president of the United Electric Light Company, of Wilmerding, retired as master controller, being succeeded by George W. Provost, president of the Union Electric Company. Other officers installed were: first auxiliary master controller, F. C. Foster, Buckeye Electric Company; second auxiliary master controller, E. F. Harrison, Allegheny County Light Company; wattmeter, George H. Criss, Westinghouse Electric & Manufacturing Company; accumulator, O. J. Goettman; master electrolyte, C. B. Minnick, Cutler-Hammer Company; regulators, Henry Harris and A. G. Pierce, Cutler-Hammer Company, and W. B. Wilkins, Westinghouse Electric & Manufacturing Company.

## Wireless Weather Reports.

Beginning April 1 the United States Weather Bureau has been receiving daily wireless reports from steamships of the Mallory, Ward and Panama lines. These reports are expected to have great value in making forecasts

## Ernest Freeman.

A subject which has been the source of much interesting and often very pertinent discussion lately is that of why electrical contracting has not always proved so profitable a business as have some other branches of the electrical industry. The contractors' associations in and around Chicago have been most active participants in the discussion of this matter, and it appears that the result of their deliberations is that what the contracting field needs more than any one thing else is better business methods on the part of contractors themselves.

A rather convincing proof of the correctness of this conclusion is found in the fact that men who have learned sound business principles in other lines have gone into the contracting field, and through the application of these correct principles and methods have become eminently successful there. A man whose experience has been of such a character is Ernest Freeman, of Chicago, senior member of the Freeman - Sweet Company, one of the most prominent firms of electrical contractors in the city.

Ernest Freeman,
First Vice-president, National Electrical Contractors' Association.

Mr. Freeman was born in Chatham, Mass., in 1870. He was educated in the schools of Chatham, and at the completion of his schooling went to Portland, Me., and began business there as a dry-goods merchant. After a short stay in Portland, he went to Chicago, where he continued in this same branch of merchandizing. After two years however, he was attracted by the opportunities which the electrical industry seemed to him to offer, and, although without any training along electrical lines to speak of, he decided to enter this field. So, eighteen years ago, he gave up merchandizing and bought an interest in an electrical contracting firm. Two years thereafter he took over the entire business of this firm and moved from the former headquarters at 84 Adams Street to larger rooms in the Boyce Building. During the five years that followed, Mr. Freeman's business grew to such proportions that he decided to form a company for its further prosecution. The Freeman-Sweet Company was organized then, and has continued doing a large contracting business ever since.

Besides caring for his contracting interests, Mr. Freeman has found time to take part in a number of other important electrical enterprises. In 1897 he organized the Freeman Power Supply Company, at Libertyville, Ill. This company, of which he was the president, did an electric lighting and power business. Its plant and other holdings were sold to the North Shore Electric Company in 1900. A second company of the same kind organized by Mr. Freeman was the United Electric Company, of Morris, Ill. This concern furnished light and power to the city just mentioned, and also to Seneca, 17 miles away. He was its president and general manager until it was bought by the Public Service Company of Northern Illinois. During this same period he was also president and manager of the Consolidated Water & Light Company of Marseilles, Ill. This last concern was sold to the McKinley Syndicate in 1909.

In matters pertaining to the general promotion of the electrical contracting business, Ernest Freeman has always taken a most active interest, and in the councils of contractors' associations he has long been conspicuous for his enthusiasm and good judgment. He is first vice-president of the National Electrical Contractors' Association, and those who claim to know about the matter will be greatly surprised if he is not its next president. He is chairman, too, of the Membership Committee of the Executive Committee of the National Association. Just now he is very actively engaged in boosting the attendance from Illinois at the approaching annual convention in Denver, having recently been appointed a member of a committee of the Illinois Electrical Contractors' Association formed for this purpose. He served a number of terms as president of the Chicago Association of Electrical Contractors, and is at this time a delegate from that body to the Chicago Building-Construction Employers' Association.

Although he has never conducted an electrical store, Mr. Freeman believes that electrical merchandizing is a legitimate branch of the contractors' activities. He thinks that even in the large city the contractor may conduct a store with profit. In fact, Mr. Freeman is seriously considering opening one himself in the not distant future.

Personally Mr. Freeman is a man of genial disposition and of temperamental optimism. He is a Mason and a member of the Illinois Athletic Club. He is married and his home is at 4063 Sheridan Road, Chicago.

## Bergmann Electric Company Reorganized.

Announcement is made of the reorganization of the Bergmann Electric Company, which controls the Edison patents in Germany. Many of its shares are held in the United States.

The company was founded by Sigmund Bergmann many years ago.

Although the corporation has done a large business, totaling $16,500,000 in 1911, and has paid dividends as high as 18 per cent, it has recently felt the effect of the active competition in the electrical trade, and reorganization became urgently necessary. This has now been effected by reducing the dividend from 12 to five per cent, and increasing the capital. The company also enters into an intimate working agreement with the Siemens-Schuckert Electric Company, which furnishes $2,125,000 of the fresh capital, the remaining $3,625,000 being supplied by a syndicate of banks.

It is announced that the Bergmann Company retains full independence in every direction.

## Meeting of the Central Electric Railway Association.

A meeting of the Central Electric Railway Association was held at the Claypool Hotel, Indianapolis, Ind., on April 4. About 150 electric-railway officials, employees and supply men attended the meeting which opened at 10 o'clock and proved to be the shortest session ever held by the association, all the business of the executive committee having been completed the evening before.

The meeting was called to order by President W. S. Whitney. Several brief reports were made by special committees, after which a discussion, in which many of the traction men participated, was had on a paper entitled "Lightning Protection," read at the previous meeting of the Association, held at Louisville, by E. J. Burdick.

This was followed by a paper on "Methods of Prevention of Fire Hazards on Electric Railroads," presented by Frank R. Daniels, of Indianapolis. Mr. Daniels said that the best method of prevention of fire hazards on electric railroads and their properties is "good house-keeping." In furtherance of good house-keeping the following general suggestions were set out by Mr. Daniels. Floor sweepings, greasy papers, oily waste, paint rags and like materials, which are subject to spontaneous ignition, should be kept in standard metal waste cans and their contents emptied and burned under a boiler each night. Ashes should be kept in metal receptacles and removed daily, care being taken not to deposit them in the vicinity of the combustible material, nor to drop live coals on wood floor. The ashes from car stoves should be emptied while cars are on the road. Workmen's clothing, particularly the greasy jumpers, should be kept in metal lockers, and discarded clothing should be burned. Oily metal turnings or filings should not be permitted to accumulate upon wood floors or in combustible receptacles, nor allowed to be mixed with sawdust or other combustible materials. Car cleaning, particularly the sweeping, should be done in the open air or in a specially designated section. The vacuum cleaning systems promote cleanly conditions and are also economical. Grease should not be allowed to collect in pits or on track bolsters and fine sand should be used to absorb, instead of sawdust. Wood turnings, shavings and sawdust should be cleaned up and removed after each day's work; automatic shavings conveyors should be attached to woodworking machines where the process is at all extensive. Fine particles should not be allowed to collect, as at certain temperatures these become explosive. The supply of oils should be kept in a separate and detached building used solely for that purpose, and not over one day's supply kept in buildings. Volatile oils should be used from standard safety cans. Lanterns should be filled and trimmed by daylight in oil house or other outside building, and filling tables should be constructed of metal. Journal waste should be kept in metal tanks, and journal boxes packed outside of the building. Heating systems should be preferable of the low-pressure steam or hot-water circulating types. Steam pipes should be kept free from contact with woodwork. Lighting should be by electricity, as that form may be considered the safest method when installed in accordance with the requirements of the National Electrical Code, and its integrity insured by proper supervision and maintenance. Portable lights should be electric, and the proper devices used to safeguard them. All specially hazardous and dangerous processes or devices which may serve to cause or promote fire should be contained in separate fire divisions of the building and particular attention be given not only to their safe operation, but to the fire-extinguishing devices peculiarly adapted to the extinguishment of fires resulting therefrom.

The final paper was read by J. L. Crouse on "The Maintenance of Electric-Railway Equipment." One of his suggestions was that the small properties follow the lead of the larger corporations in the employment of technical graduates in responsible positions. He advised the companies to establish regular apprenticeship courses for young men in their employ, and that they arrange their organization so that a fairly attractive position will exist for the technical graduate. He pointed out that the smaller roads offer better opportunity for the technical graduate, because with them he is brought into contact with actual conditions.

President Whitney announced that the next meeting of the Association would be held at Cedar Point, O., June 12, 13 and 14, and would be in the nature of a summer outing.

## Cotton Manufacturers to Meet.

The semi-annual meeting of the National Association of Cotton Manufacturers will be held in Boston, Mass., on April 24 and 25. Sessions will be held in Mechanics' Building, and in the same building there will be an exhibit of textile machinery the same week.

Among the papers to be read are "Steam Efficiency in Textile Plants" and "Transmission of Power by Rope."

## Program of Pacific Coast Meeting of the American Institute.

The 271st meeting of the American Institute of Electrical Engineers will be held at Portland, Ore., April 16 to 20. F. D. Weber, of Portland, Ore., is chairman of the Convention Committee. Headquarters will be in the Multnomah Hotel. Arrangements have been made for reduced fares from all points on the Pacific Coast for those attending this meeting.

The following papers will be presented: "Operation of Two Alternating-Current Stations Through Parallel Circuits and the Distribution of the Load and Wattless Current Between Them," by J. W. Welsh; "Air-Gap Flux Distribution in Direct-Current Machines," by Charles R. Moore; "Principles to be Considered in Selecting a Water-Wheel Unit," by O. B. Coldwell; "Irrigation in the Spokane Valley," by L. J. Corbett; "An Underground System and a Few Developments," by S. B. Clark; "Alternating-Current Systems of Underground Distribution," by S. J. Lisberger and C. J. Wilson; "Automatic Private-Branch-Exchange Development in San Francisco," by Gerald Deakin; "Long-Distance Telephone Transmission on the Pacific Coast," by C. A. Turner; "The Design of Telephone Pole Lines for Conditions West of the Rocky Mountains," by A. H. Griswold; "The Application of Automatic Selecting Devices to Telephone Multiple Switchboards," by A. H. Dyson; "Plant Efficiency," by J. D. Ross; "Practical Joint-Pole Construction," by J. E. Macdonald.

The opening session will be held on the morning of Tuesday, April 16. Sessions for the reading of papers will be held on Tuesday afternoon, Wednesday morning and afternoon, Thursday morning and afternoon. On Tuesday evening there will be a banquet, and on Thursday evening an illustrated talk will be given by A. H. Babcock on "Operation of 1,200-Volt System of the Southern Pacific Company." Trips will be taken to Oregon City, to the plants of the Portland Railway, Light & Power Company, to the Mount Hood Railway & Power Company and other places, Wednesday afternoon, Friday and Saturday being devoted to such trips.

## Meters Used in European Countries.

Official figures showed that the number of electric meters in use in Germany in 1910 was over 1,000,000. It is estimated that in Austria there are 500,000 in use. Over 400,000 meters have already been tested in the latter country.

# Central-Station Service for Dock Machinery.

By C. A. Tupper.

An opportunity for the use of current from electric central stations which has been almost entirely overlooked in this country, but is extensively developed abroad, consists of its application to the loading, unloading and handling over short distances of freight of all kinds in ocean or river harbors and along canals; also for the operation of motor-driven pumps to raise or maintain the water level of basins and locks, fill dry docks, etc., not to mention electric towing equipment like that used on the famous Teltow canal.

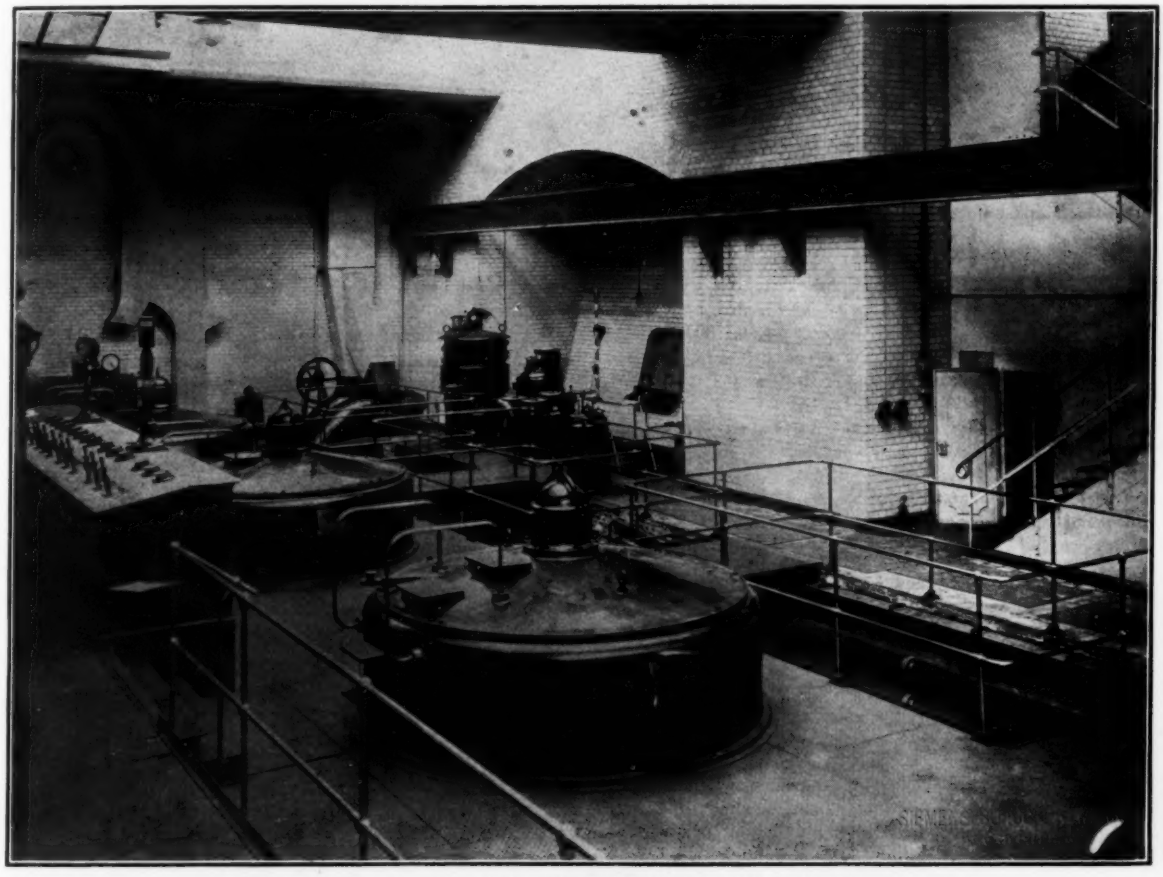


Fig. 1.—Pumping Plant at Wilhelmshaven Equipped with Electric Motors.

No one who has not made a trip among European harbors, particularly in Germany, can have any adequate idea of the extent to which electric current is applied in the promotion of water traffic and the handling of water-borne commodities.

Lining the wharves, river and canal landings and sides of industrial basins are traveling cranes running on their own tracks, or else long rows of stationary swinging or revolving cranes. The traveling cranes include every type for outdoor service, from huge gantries or swinging cranes moved on the ground to the small extension or portal cranes, with hoists, propelled along tracks laid on the sloping warehouse roofs; while the fixed variety range from mere jib and pillar cranes to derrick and boom cranes mounted on half-circle tracks or turntables. By means of these, with their various hooks and grappling attachments, clam-shell buckets, lifting magnets, auxiliary hoists, etc., both package and bulk freight, are taken directly from cars or warehouses to boats and vice versa.

In addition there are motor-turned capstans, motor-operated car shunting mechanisms for yard switching without locomotives, motor-actuated tipples each of which handles a standard-size freight car with its load, motor-driven elevators, conveyors and aerial tramways, electric weighing and recording devices, motor-operated gates for locks and basins, motor-driven pumps, and electric control systems by means of which operation can be made almost or quite automatic and regulated, if need be, from a distance. All of this vast machinery, too, is for the service of shippers and receivers of freight in general, besides the ore and coal loading or unloading bridges, etc., which are maintained by private corporations and usually operated on current from their own power plants. These last-named differ in no essential feature from those of American concerns similarly engaged; but the facilities placed at public disposal, so to speak, in the seaports, river harbors and canals, form an aggregate which is far in advance of anything known to this country. It has had, also, a large influence upon the extension of electric power over wide districts and has benefited the central-power companies operating in the industrial districts, where

the chief cities are nearly always in communication by water with the outside world. The idea of providing such handling facilities between vessels and land-transport or storage considerably antedated the general use of electric current. The cranes, etc., originally installed were operated by steam or hydraulic power, and large numbers of these are still to be seen; but they are being rapidly displaced by electric appliances; and a network of cables now traverses in every direction the docks and basins of each important sea or inland port. Naturally,

Fig. 2.—Traveling Shore Cranes Between River Boats and Railroad at Mannheim.

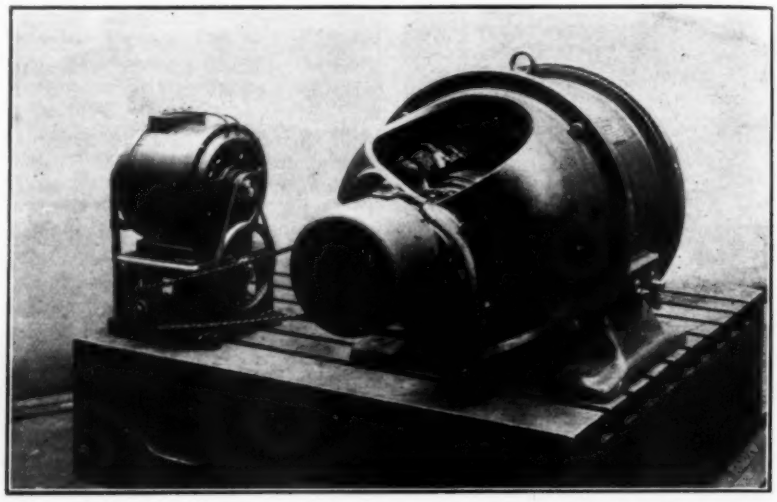


Fig. 3.—Single-Phase Brown-Boveri Motor with Automatic Brush Shifter, Used for Harbor-Crane Service.

also, electric illumination has kept pace with other developments, and at times the harbors show as much activity by night as by day.

There is no question but that the present movement for the improvement of harbors and waterways in the United States should include provision for freight-handling facilities, at wharves, landings and levees, at least equal to those of European cities; and the most economical method of operating them will nearly always be on current from the

Fig. 4.—Long-Reach Crane at Cuxhaven.

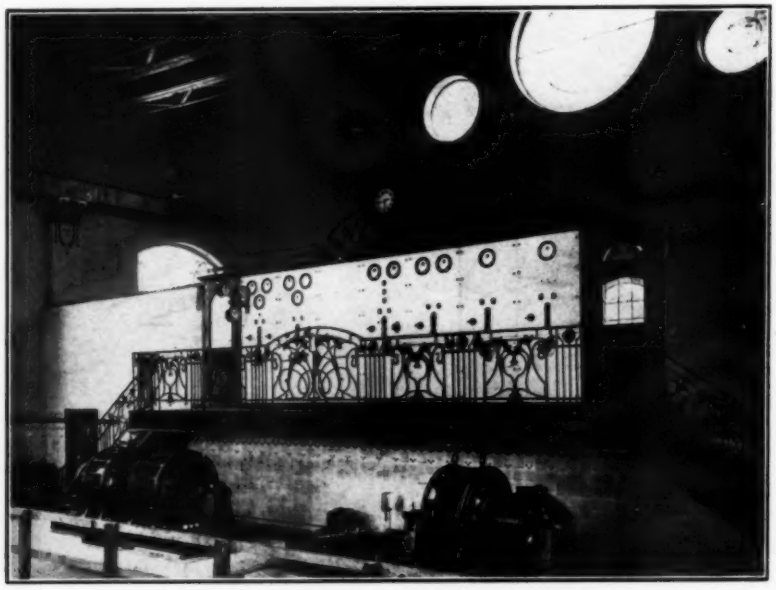


Fig. 5.—Substation at Harbor, Frankfurt-on-the-Main.

local central station supplying electric service.

Furthermore, the use of basins in which the water level is maintained by means of electrically operated pumps ready for service at any moment but consuming no current when they are not needed, enables vessels of any specified draft to be accommodated without the necessity for the expensive dredging which has made the cost of so many projected harbor improvements in this country practically prohibitive. This method has proved so economical and otherwise satisfactory that it was recently decided upon as the basis of all further improvement of the great dockage districts along the Thames below the city of London, England; while on the Continent one comes across these basins and their motor-driven pumps on every industrial water front. They are entered by vessels through locks similar to those of canals. In one of the accompanying illustrations is shown such a plant at Wilhelmshaven, Germany. This is the port over which there has been so much excitement in that country, of late, on account of the alleged betrayal of the harbor plans to the English and the reported discovery of a plot to blow up the basin walls, dry-docks, pumping plants, etc., in case of the sudden outbreak of a war over Morocco. The station shown figures in the conspiracy said to have been disclosed, and no more photographs in or about it are now allowed to be taken.

To get back to everyday affairs, however, there is the further fact to be taken into consideration, as demonstrated abroad, that the maintenance of facilities for the quick, economical transfer of freight at any point where "rail meets sail" attracts a rapidly increasing volume of trade to the communities thus favored, brings in new industries, etc., and results in its steady growth. This, of course,

means the simultaneous stimulation of an ever-widening demand for electric current and the growth of the central-station service to meet it. The managements of all such companies have, therefore, a special incentive to encourage improvements of the character above outlined.

It is also of interest to note, in this connection, that use is being made in Europe of the water power developed in the canalization of rivers, by the differences in levels produced, and at the outlets of the chains of storage reservoirs constructed to act as feeders for navigable streams in seasons of dry weather. Specific examples of this are the power plants of the new Weser storage dam at Hemelingen, near Bremen, and at one for similar purposes in the vicinity of Doeverden. The former will be utilized to produce electric current for the operation of dock equipment, while that generated at the latter is to be transmitted to Minden, over the famous battlefield, to run a pumping plant for maintaining the water level in the canal connecting the Rhine with the Weser.

Fig. 6.—Unloading Bridge and Shore Cranes, Duisburg-Ruhrort.

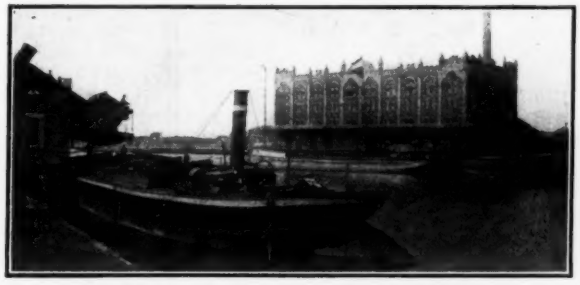


Fig. 7.—Car Tippler at Dortmund, Germany.

Fig. 8.—Traveling Crane at Cologne.

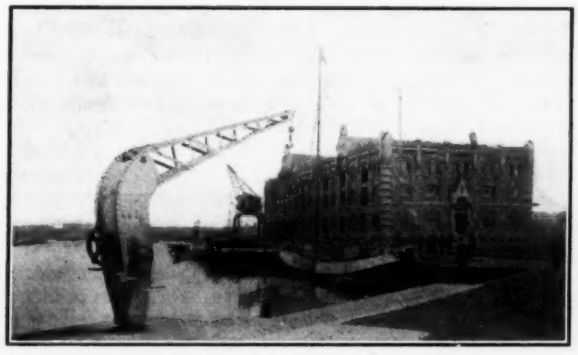


Fig. 9.—Cranes and Warehouse at Stettin.

## Secures Large Power Contract.

The American Sugar Refining Company, South Boston, Mass., has entered into a contract with the Edison Electric Illuminating Company of Boston, for 350 horsepower in motors. The plant operates 24 hours per day. This installation is supplementary to a 2,000-horsepower equipment of motors now being installed.

## Boston Electrical Luncheon.

The weekly meeting of the Luncheon Club branch of the New England Section of the National Electric Light Association was held at the American House, Boston, on April 5, there being 175 members and guests present. L. W. Downes, general manager of the D. & W. Fuse Company, of Providence, R. I., gave a lecture upon "Closed-Fuse Design," and exhibited a number of oscillograms showing the current and voltage changes occurring during the blowing of fuses under various conditions. He pointed out the great value of the oscillographic method of investigation, which enables the fuse manufacturer accurately to study the changes occurring in the interior of the cartridge during the fractional parts of a second that such phenomena occupy. Among the points brought out in the address were the value of multiple-link fuses as contrasted with single strips, the interference of inductive load upon the accuracy and reliability of the fuse, and the need of keeping down the volume of metal to about one per cent of the volume of the inclosing chamber in the case of 600-volt fuses. The momentary current often rises in a blowing fuse to one hundred times its rating at the instant of short-circuit. The speaker gave an opinion that the reason why so much trouble is a feature of fuse operation on very-high-tension circuits is a sort of Nernst effect. The circuits usually are more or less inductive, and this retards the temperature rise of the links to the melting point; the protracted flow of energy heats the filling to a point where its resistance falls considerably, and a sustained arc results.

## Illinois Students Take Trip.

A trip of inspection was taken during the week beginning April 1, by senior students in electrical engineering of the University of Illinois. A large party of students accompanied by professors left the University on April 2 for Chicago and other points in the northern part of the state. The party visited the Illinois Steel Company's works and the mills of the American Steel and Wire Company in Joliet; inspected the power-plant development in connection with the drainage canal at Lockport; and spent two days in and about Chicago, visiting some of the pumping stations of the sanitary district, some of the larger business houses, the Western Electric Company, the Illinois Steel Company, and the various stations of the Commonwealth Edison Company.

## Convention of Illinois Contractors.

The Illinois Electrical Contractors' Association will hold its semi-annual convention in Rock Island, June 14 and 15.

# Commercial Practice
# Management, Rates, New Business

## WHAT WILL THE CENTRAL STATION DO FOR THE ELECTRIC VEHICLE?

By H. S. Conkey.

**The attitude that the central station should take towards the introduction of the electric vehicle is now well recognized by central-station managers.. The extent to which the Minneapolis General Electric Company will undertake the development of this desirable business is outlined in this article.**

For some time past the electric vehicle has been offered to the public for transportation purposes, in both pleasure and commercial types. The earlier styles of cars were more or less crude and not wholly fitted to do the work expected of them. Nevertheless the "electric" for both pleasure and commercial purposes has always been, to a certain degree, attractive to the public. Had the general public been better informed as to what to expect from an electrically driven car, in other words, had the electric vehicle been kept in its own sphere of general use and the public rightly informed as to just how to obtain the best results from this class of vehicle, then the electric-vehicle industry would have had a much better and steadier growth from its inception, and would, undoubtedly, be much in advance of its present position in the transportation world of today.

During the last five years many improvements have been adopted in both the vehicle and its battery, and with intelligent care, and selection of the right vehicle for the proper work, the central station can now feel that the time is at hand to see that this branch of the business is properly developed, and that the electric vehicle for both pleasure and commercial purposes gets its proper standing in the community as a reliable, safe and not expensive form of transportation.

The records available for the last two or three years, where electric vehicles have been in use, show that the electric, when properly adapted to the work for which it is designed, and with proper care, is the cheapest and by far the most convenient and desirable form of urban tranportation which can be used.

When the central station is in a position to show actual cost of electrics in use in its own field of business, it will be evident to others that the electrically-driven vehicle is more economical than its competitors, namely the horse-drawn vehicle and the gasoline car.

The cost of operating vehicles may be classified as follows: (1.) general expense, such as supervision, garage rent and state license; (2) operating expense, cost of oil, supplies, general repairs, cost of current, repairs on batteries and tires, drivers' salaries, washing, oiling, garage expense, etc.; (3) fixed charges, interest on investment, taxes, insurance and depreciation.

From reliable data covering operating expenses over a period of three years we have the following figures on one and one and a half-ton wagons:

| | |
|---|---|
| Average days in service per month | 24.5 |
| Average miles per day per wagon.. | 29.5 |
| Average kilowatt-hours per mile... | 0.49 |
| Car Operating Expense Per Mile: | |
| Oil and other supplies..... | 0.6 c |
| General repairs ..... | 1.4 c |
| Electric energy at 4 cents per kilowatt-hour ..... | 2.0 c |
| Tires ..... | 1.62c |
| Batteries ..... | 1.7 c |
| Total..... | 7.32c |

To find the total operating expense the following items should be added: salaries of drivers; cost of washing and minor repairs, and garage expense. As these last items are variable no accurate figures can be given.

When a central station decides to create and develop an electric-vehicle market and goes to the trouble and expense of working out this problem, it should maintain a conspicuous position in this work, as the public is more or less uninformed as to the principles underlying the care and maintenance of the electric car. If properly cared for the electric truck or pleasure car is an economical success, but if allowed to care for itself, as is often the case, only expensive and indifferent service can be expected.

Unless there is some influence in the field that will start an educational campaign there is liable to be a lack of knowledge in regard to repair bills and charges for general upkeeping of the electric vehicle. The average owner being in no position to criticise work done on batteries, or the car in general, is sometimes at a loss to know what is necessary and does not understand the art thoroughly enough to know when the work has been honestly accomplished.

The central station should feel that the consumer's interest and its own are the same. Maximum service with minimum cost will do much to increase the popularity of the electric vehicle.

It is of vital importance that the consumer should know before buying what his requirements are, as the ensuing monthly bills for current and repairs are to determine whether this one customer is going to be satisfied and probably repurchase in the future, or is to be made a stumbling block in the path of progress on account of not having the proper information at his disposal.

In the case of the pleasure car the salesman's efforts to meet the customer's requirements often leads him to make promises as to mileage, speed, etc., that cannot be fulfilled with the standard cars under all road and weather conditions. The customer not understanding the effect that cold weather and poor roads have upon a car, as regards mileage per charge, will often think the car is at fault.

The efficiency of tires on electric vehicles is also of great importance, as it has been found that there is a difference of from 30 to 70 per cent between heavy tires, as are sometimes used, and the best special electric-car tire. This means that with suitable tires an electric pleasure car may double its mileage, and the life of its battery will probably be increased in about the same proportion, provided, however, the car receives the proper attention otherwise. This question of tires alone will often account for widely different current consumption between two customers having the same make of car, doing approximately the same work.

Therefore, it is evident that the central station car can do considerable for the electric vehicle, so it may receive proper recognition for both commercial and pleasure uses.

There are two ways in which the central station can promote the use of electrics: First, enter the field as an active competitor; second, act in an advisory way as an unbiased agent regarding all deals pertaining to electric vehicles.

The central station should, before deciding what its position in this matter is to be, study and examine the local conditions carefully and decide the attitude which is best suited, as the conditions seem to warrant. Once established this policy should be closely adhered to and

at all times the company should have a certain amount of jurisdiction over the situation, for by so doing the central station will be aiding this branch of the business in a manner which would be impossible for others. The public will quickly become cognizant of the fact that there is someone that they can turn to and be assured of a correct analysis of the situation.

The central station entering into an electric-vehicle campaign should select a man whose knowledge and experience in the business will make him capable of handling not only the prospective purchasers, but the dealers as well. For if the project is to be a success the confidence of both is essential. He must be tactful as well for he will be called upon to visit the different dealers to see that their efforts are being directed along the same line of campaign, and he will, undoubtedly, be called upon from time to time to decide various questions. Right here he must exercise excellent judgment, for one or two mistakes will do much to offset the confidence of the trade and ruin much prospective business. He must be able to differentiate, between the electric and the gasoline sphere, correctly, lest the purchaser be led to buy something not fitted to his needs. He will also be called upon to advise in the selection of vehicles for different classes of business, and the merchant or his battery man must be instructed as to the best method of charging and what results he is to expect in regard to tires, mileage, etc.

As no set of rules will apply to this phase of the business the man in charge of this work for the central station must be thoroughly capable to cope with conditions as they arise, and as the field enlarges he must be reinforced with capable assistants who will carry out his ideas effectually.

As the charging of vehicle batteries is an offpeak business the central station will do well by taking this feature into careful consideration and apply such rates as will be reasonable and equitable for this class of service, which in itself should not require added station capacity, and if properly fostered will do much in the future towards improving the load-factor.

The central station should also give added impetus to this work by installing and using electric vehicles in its own business, wherever possible, not only on account of the saving to be obtained but as an encouragement to the business all along the line.

It is also necessary that the central station, as well as others, keep accurate and reliable records of the actual cost of operation of their vehicles. These records should be available at all times to those who are interested. This in itself will prove a vast help in building up a vehicle load as most purchasers like to be shown what is being done in their own city, rather than read data from some distant place.

There is no more convincing argument than being able to show records of actual results obtained at the present time under the present conditions, and by being able to do this the central station will have put its house in order, in regard to the electric vehicle, and will be in a position to say to the public "Go thou and do likewise."

## A Novel Portable Testing Station.

The Edison Electric Illuminating Company, of Boston, has recently placed in service a portable high-potential testing set of large kilovolt-ampere capacity. The set consists of two electric trucks, one carrying a motor-generator set, switchboard and cables, the other carrying a step-up transformer, reactance and switchboard.

Trucks No. 1 and No. 2, numbered according to the order in which they were put into service, weigh 21,000 and 23,000 pounds respectively. They are of 5 to 6-ton capacity, General Vehicle manufacture, and each is equipped with Edison A-12 batteries. Their average speed is about six miles per hour, and when the running conditions are good, they are able to cover 30 miles on a single charge of the battery. About 15-ampere-hours are consumed per mile. Each battery contains 60 cells, rated at 450-ampere-hours each, and have a normal discharge rate of 90 amperes.

Truck No. 2 contains the following equipment: One 100-kilowatt, three-phase, 2,200 or 4,000-volt 60-cycle induction motor, connected by flexible coupling to one 100-kilowatt, three-phase, 2,200-volt, 60-cycle synchronous generator, which has a two-kilowatt, 120-volt exciter mounted rigidly on the shaft outside the outboard bearing. In addition to the motor-generator set there is a starting compensator for the motor and a switchboard equipped with the necessary automatic oil switch, rheostats, measuring transformers and instruments. This truck also carries the jumper cables used in connecting the apparatus to the source of supply, and to the cable or the apparatus under test. These jumpers are coiled on reels mounted permanently on the truck.

Truck No. 1 carries the following apparatus: one 800-kilovolt-ampere single-phase, 2,200-30,000-volt, 60-cycle transformer; one 850-kilovolt-ampere, 2,200-volt, 60-cycle variable reactance; two complete motor-driven blower sets for cooling transformers and reactance; one five-kilowatt, 2,200-220-volt, three-phase, 60-cycle transformer for the blower motors; one 15,000-volt potential transformer and switchboard equipped with knife and oil switches, measuring transformers and instruments. This truck also carries reels for small wire, a terminal board for jumper leads, a spark gap and resistance, a lamp-bank rheostat connected with the truck battery, and a power bridge. In addition there is a 30,000-60,000-volt electrostatic voltmeter; a complete outfit for measuring insulation resistance and electrostatic capacity; and apparatus of the exploring type for locating the cable faults. The equipment is used mainly for underground cable tests.

A word about the method of testing. The motor is connected through flexible jumpers to a supply of 60-cycle, three-phase power at either 2,300 or 4,000 volts. The connection is made to a tion switchboard, if convenient, or to an overhead or underground line. The high-tension side of the step-up transformer is connected to the cable under test. A suitable value of reactance is chosen such that the leading current flowing to the cable will be approximately balanced by the lagging current flowing to the reactance. The pressures used range from 15,000 to 30,000 volts and the time of application from 5 to 30 minutes. The apparatus will test at 30,000 volts more than five miles of 4/0 three-conductor, paper-insulated, 15,000-volt, lead-covered cable.

By means of these tests of the entire system of underground transmission lines every precaution is taken against possible interruption due to imperfect insulation of cables and unsatisfactory workmanship in installing them.

## Where Cost of Motor Drive Is Secondary to Reliability.

To central-station companies fighting competition of gas-engine drive, the following experience of the Oklahoma Gas & Electric Company may be of interest. Oklahoma City, as is well known, is situated in the center of a natural-gas district, the price of gas for power purposes averaging between 11 and 16 cents per 1,000 cubic feet. In spite of this, during the past year over 2,500 horsepower in motors has been installed by the electric company, although comparatively little manufacturing is done in the city.

The particular installation in question is in a produce company's plant where a 12-horsepower gas engine was operating a refrigerator compressor. This gas engine was using natural gas at the rate of $8.00 per month. The Oklahoma Gas & Electric Company made several attempts to interest the proprietor, but the wisdom of substituting a motor, which it was esti-

mated would cost between $60 and $70 per month to operate, for the gas engine costing $8.00, was questioned. Finally the electric company prevailed upon the proprietor to make a careful estimate of the amount of fruit lost annually due to lack of refrigeration, when the gasoline engine was being repaired, overhauled, etc. This loss figured for a period of several months, averaged from $100 to $200 per month. Needless to say the motor was installed, and today the installation has been doubled and the gas engine disposed. Also, this customer personally influenced a competitor to make a similar change.

## A. Larney.

A. Larney, who has recently been appointed manager of the new-business department of the Consumers' Power Company, has established an enviable reputation in central-station commercial activities, and his rapid rise in the industry is due principally to the aggressive and progressive new-business methods he has adopted, and also to his magnetic personality, which has won him a host of friends.

Mr. Larney was born in Philadelphia, Pa., January 21, 1879. After graduating from high school he engaged in the business of electrochemistry, and after several years' experience in this line, moved to Cleveland, Ohio, entering the manufacturing end of the electric business, becoming connected with the A. & W. Electric Sign Company of Cleveland. In this position he spent three years traveling about the country conducting electrical advertising campaigns and promoting "White Way" systems in connection with the various central stations, boards of trade, civic associations, etc.

Later he accepted a position with the commercial department of the Dayton Lighting Company, Dayton, Ohio, under the management of F. M. Tait, the present first vice-president of the National Electric Light Association, under whose tuition he received valuable experience in central-station commercial practice and aggressive new-business methods. After remaining there two years, he accepted a position with H. M. Byllesby & Company of Chicago, and was assigned as new-business manager of the Oklahoma Gas & Electric Company, Oklahoma City.

During his connection with this company, the building activity in that wonderful city of the Southwest was astonishing. At times the permits amounted to a million dollars per month, and the United States census reports showed an increase in population for the city of 542 per cent, proving it to be the fastest growing city in the world, all of which progress meant the erection of numerous large office buildings, hotels, department stores, etc., in which the company was obliged to compete with many proposed isolated plants, for natural gas on manufacturers' rates could be purchased as low as 11 cents per 1,000 cubic feet. Competition was rather keen on gas engines and isolated plants in general, but during the year and a half of Mr. Larney's supervision over the commercial development in that vicinity, the company succeeded in increasing the number of meters installed 20 per cent. The company also added several thousand horsepower and prevented the installation of a single isolated plant, irrespective of

A. Larney.
New-Business Manager, Consumers Power Company.

size, so that in power results the company enjoyed a percentage of 100 on the available new power business. This included some installations, of which the revenue exceeded $10,000 a year, a rather fair report for a non-manufacturing community of 70,000 people.

After a short time Mr. Larney received a promotion and was given jurisdiction over the following properties, with headquarters at Oklahoma City: Enid, Okla.; El Reno, Okla.; Muskogee, Okla.; Sapulpa, Okla., and Oklahoma City. Among the accomplishments at the above properties, the one most worthy of mention was the contract obtained for the city pumping at Sapulpa, Okla. The Byllesby Company had just taken over the property and began negotiations with the city for municipal pumping as the city had issued bonds and awarded contracts for the purchase and installation of a steam-driven pumping station of approximately 500 horsepower, so that at the time of action on this proposition all the boilers, engines and other apparatus was in the process of manufacture; however, after two months of effort, Mr. Larney succeeded in inducing the city to reconsider the subject, and obtained a complete cancellation of all machinery ordered and releases from liability from all the manufacturers, and the signing of a ten-year contract for electric power and motor drive throughout.

In January of this year Mr. Larney received another promotion and was appointed manager new-business department of the Consumers' Power Company properties, including Consumers' Power Company, St. Paul, Minn.; Interstate Light & Power Company, Galena, Ill.; Consumers' Power Company, Faribault, Minn.; Consumers' Power Company, Mankato, Minn.; Consumers' Power Company, Stillwater, Minn.; Union Light, Heat & Power Company, Grand Forks, N. D.; Red River Power Company, Grand Forks, N. D., and Consumers' Power Company, Minot, N. D., with present headquarters in St. Paul, from which the commercial work of the above companies is directed.

Since going to St. Paul Mr. Larney has succeeded in establishing a new record for power development among the Byllesby properties, having contracted with several of the largest manufacturing enterprises in the city, and shutting down numerous steam-driven plants which have been operating for years, ranging from 300 to 1,800 horsepower each.

## Lower Lamp Rate in Covington.

A 10-year agreement is to be made by the Union Gas & Electric Company, of Covington, Ky., whereby the company will maintain electric street lamps at rates considerably below those which have been charged heretofore. The schedule of rates, which is subject to approval by the city and the company, is $55 per lamp per annum in the district where the wires of the company are underground, and $50 in the overhead district. $72 and $60, respectively, have been paid heretofore.

## Power for Exhibit Hall.

The Kentucky Electric Company, of Louisville, has contracted with the Fraternity of Operative Millers of America, which is to hold its annual convention in Louisville, June 3-8, to furnish light and power for the exhibits which will be installed in the First Regiment Armory. This is one of the largest exhibition halls in the country, having 50,000 square feet of floor space, and will be entirely covered with live-machinery exhibits, constituting the most complete display of milling apparatus ever arranged.

# Electrical Construction

## NOTES ON ELECTRICAL CONSTRUCTION.

By George J. Kirchgasser.

**This is the last of a series of articles on electrical construction. The matter is treated in a thoroughly practical manner, and covers every phase of construction usually encountered by the electrical contractor or the electrician in an industrial plant. This article discusses in detail the wiring of alternating-current motors and transformers.**

### Wiring and Other Installation Rules for Alternating-Current Motors.

The calculation of wire sizes, fuses, etc., is somewhat more complicated and difficult for alternating-current motors than for direct-current motors. The squirrel-cage motor is very often fused improperly, is provided with small leads, and frequently installed in other than the best manner.

The National Electrical Code ruling that leads or branch circuits to motors must be of such capacity as to carry a current at least 25 per cent greater than that for which the motor is rated, is generally satisfactory in service for the direct-current motor. Leads of this extra capacity can be fused with fuses not greater than their rated capacity and at the same time allow for the extra starting current. This is not sufficient usually for alternating-current motors, especially the squirrel-cage type, which takes from three to nine times its normal current when starting. For this reason starting and running fuses are often provided with this type of motor, as shown in Fig. 1. The abnormal current required when starting makes it necessary to have fuses that will allow much more than the rated full load current to the motor. If running fuses were not provided there would be practically no protection during running because of the starting fuses being so large.

In the table of carrying capacities of wires a separate column of ampere capacities is given for rubber-covered wire and one for wire with insulation other than rubber. Rubber-covered wire is allowed a somewhat smaller capacity because of possible deterioration or drying of rubber insulation with age and heat. Where rubber-covered wire is used the New-Code ruling allows the starting fuses for squirrel-cage motors, or others requiring large starting currents, to be selected according to the allowable current-carrying capacity of wires having other than rubber insulation. Circuit-breakers having time element devices must be set not over 30 per cent above the allowable carrying capacity of the wires.

Take the case of a three-phase squirrel-cage motor requiring 20 amperes per phase at full-load running speed, started by a compensator which limits the starting current to 80 amperes. No. 10 rubber-covered wire carries 24 amperes but the rule requires a wire of 25 per cent greater capacity, which is a No. 8, rated at 33 amperes. The Code allows fusing according to the column for other insulated wires, which for No. 8 wire is 46 amperes. This could be fused by 50-ampere fuses but the 80 amperes which, we stated above, is required for starting would blow these 50-ampere fuses. Fuses of higher capacity would not provide protection for the leads which, as also stated above, have a allowable carrying capacity of 46 amperes. In case large fuses were installed it would be possible for a larger current to flow continuously in the conductors. Larger conductors are necessary. In selecting the conductors or leads for an alternating-current motor—of the squirrel-cage type, particularly—the conditions under which the motor will be started and the length of run also should be carefully considered. Disregarding length of run for the moment, conductors should generally be of 50 per cent to 125 per cent greater capacity in order to allow for their proper fusing protection. For the motor in the example above a No. 6 wire would be satisfactory. Fuses of 65 amperes, which is also the carrying

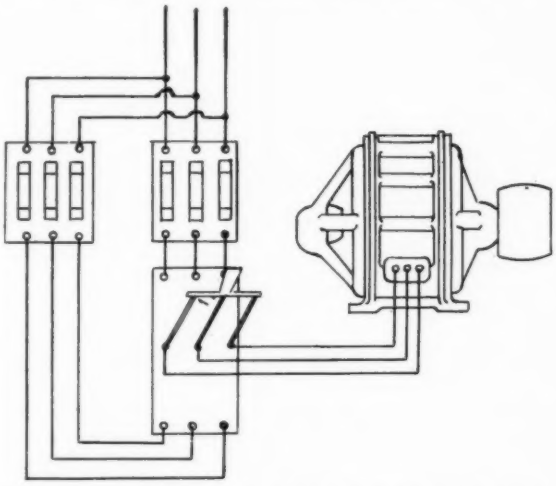


Fig. 1.—Diagram Showing Both Starting and Running Fuses for Small Motor.

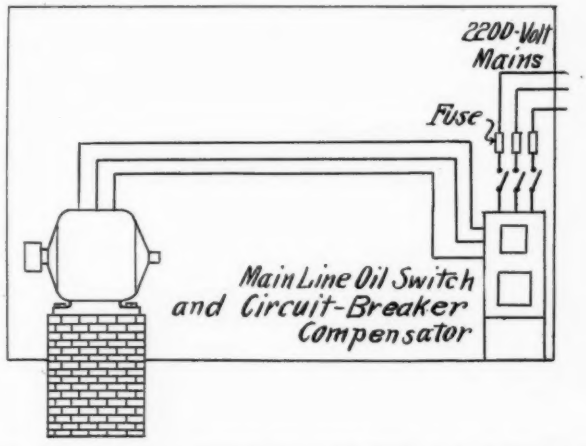



Fig. 2.—Typical Arrangement for Installation of High-Voltage Motor.

capacity of weatherproof No. 6 wire, will stand about 70 amperes continuously without blowing and 80 amperes momentarily. If the motor was started with no load whatever, the starting current might not reach 80 amperes, while in some cases it might run up to 100 or more.

Each wire of motor circuits, except on main switchboards in central stations or in power houses where there is competent supervision, must be protected by an approved fuse, whether automatic overload circuit-breakers are installed or not. Single-phase motors may have one side protected by an approved automatic overload circuit-breaker if the other side is protected by an approved fuse. For large motors where the capacity is in excess of the capacity of approved fuses approved circuit-breakers only are recommended.

The general information regarding installation, mounting, grounding and insulating that was given concerning direct-current motors applies also to alternating-current motors. The latter type are frequently used in much greater capacities and at higher voltages, and a reference here because of the increased number of these installations may be pertinent.

### High-Voltage Motors.

In some sections of the country in the vicinity of large water power plants especially, as in Western New York, many 2,200-volt three-phase induction motors are used in the industrial and manufacturing plants. Where many men are employed in plants of the above kind, there is considerable danger, and for this reason the amount of wiring carrying the high-voltage current is reduced to a minimum. The motors, with their starting devices, etc., are placed in separate motor rooms, one wall at least of which is an outside one so that the wires need only enter this one room. These high-voltage motors are, as a rule, of large capacity—100, 150, 250, 500, 1,000 and 1,500 horsepower—and are usually set up on concrete or brick foundations. Fig. 2 gives an idea of a typical arrangement of wires, motor and starting compensator panel for this kind of installation.

Just below the point of entrance fuses and disconnecting switches are placed and the wires then connected to the main-line oil switch and circuit-breaker on the panel. The wires, which are rubber-covered, are run as special open wiring, supported on glass petticoat insulators, which hold the wires, in plain sight and about two inches from the surface of the wall and about ten inches apart. Eight inches is the minimum distance approved for this class of wiring. The insulators should be spaced about four to five feet apart so as to firmly support the wires. In buildings of mill construction where the ceiling timbers are a greater distance apart than five feet, the wires may be separated a minimum of ten inches and supported at every ceiling timber if the wires are No. 8 B. & S. gauge or larger. Smaller wire is not considered mechanically strong enough to risk a very great span.

If these high-voltage wires are liable to be exposed to mechanical injury they must be protected by boxing or else placed in metal sheath and conduit.

Where several high-tension motors are installed in the same plant the wires can best be run to the various locations outside on poles. This is much better than running them inside; also costs less and is safer.

Where motors are located away from outside wall positions or where the open wiring as shown in Fig. 2 would not be advisable, lead-sheathed, multiple-conductor cable is run in iron conduit to the motor and starting compensator. The metal sheath and conduit should be thoroughly connected with a ground wire by means of ground clamps and the conduit and other fittings and casings of the compensator used with the high-voltage circuit should be bonded or connected together permanently. Where the high-potential conductors leave the metal sheath at a junction at the motor, starting device or at any outlet, the insulation must be well protected from moisture and mechanical injury or this point may prove to be the weak link in the chain. The iron conduit in which the cable is run should be terminated by a bushing, which is approved where metal-sheathed cable is used, and the insulation of the wires where leaving the sheath be protected by means of a pothead or some equivalent construction. The starting compensator—if squirrel-cage motor—is usually mounted on the same panel with the circuit-breaker, oil switch and wattmeter.

In alternating-current circuits besides the ohmic resistance such as is found in direct-current circuits there are also inductive effects, and also what is called skin effect. In another part of this series of articles the establishment of a magnetic field about a conductor in which current was flowing was discussed. This magentic field is produced by the flowing of electric current, and as with an alternating-current the direction of flow is reversed twice each cycle, the effect of the induced current and of the induced action on nearby conductors is of considerable importance.

Skin effect occurs generally in large conductors, above 4/0 size, and is the result of the uneven distribution of alternating current over the cross-sectional area of the wire. Near the center very little current will be carried, so that this part is wasted and the capacity of the conductor reduced. As solid conductors as large as 4/0 B. & S. wire are seldom used for motor work, the allowance for skin effect may be disregarded in the calculation of wire sizes.

On a direct-current system, the efficiency and horsepower of the motors, the voltage, length of run and line loss are considered when calculating the conductors, but with alternating-current circuits the impedance of the line and the power-factor of the load must also be considered. The direct-current formula does not apply to alternating-current circuits except where incandescent lamps constitute the entire load. In this case the power-factor is

ALLOWABLE CARRYING CAPACITIES OF COPPER WIRES AND OTHER DATA.

| B. & S. Gauge. | Diameter, Inches. | Circular Mils. | Amperes, Rubber Insulation. | Amperes, Other Insulations. | Ohms per 1,000 feet at 75° Fahr. | Pounds per 1,000 feet. |
|---|---|---|---|---|---|---|
| 18 | .040 | 1,625 | 3 | 5 | 6.21 | 4.5 |
| 16 | .050 | 2,583 | 6 | 8 | 3.97 | 7.8 |
| 14 | .064 | 4,106 | 12 | 16 | 2.53 | 12.5 |
| 12 | .080 | 6,530 | 17 | 23 | 1.589 | 19.8 |
| 10 | .101 | 10,381 | 24 | 32 | 1.000 | 31.5 |
| 8 | .128 | 16,510 | 33 | 46 | .63 | 50.0 |
| 6 | .162 | 26,250 | 46 | 65 | .392 | 79.0 |
| 5 | .181 | 33,100 | 54 | 77 | .31 | 100.0 |
| 4 | .204 | 41,740 | 65 | 92 | .248 | 126.0 |
| 3 | .229 | 52,630 | 76 | 110 | .197 | 159.0 |
| 2 | 257 | 66,370 | 90 | 131 | .157 | 200.5 |
| 1 | 289 | 83,690 | 107 | 156 | .123 | 253.0 |
| 0 | .324 | 105,500 | 127 | 185 | .099 | 319.0 |
| 00 | .364 | 133,100 | 150 | 220 | .077 | 402.0 |
| 000 | .409 | 167,800 | 177 | 262 | .063 | 506.0 |
| 0000 | .460 | 211,600 | 210 | 312 | .05 | 640.0 |
| .... | .633 | 400,000 | 330 | 500 | .025 | 1,211.0 |
| .... | .708 | 500,000 | 390 | 590 | .02 | 1,514.0 |
| .... | .744 | 600,000 | 450 | 680 | .0168 | 1,817.0 |
| .... | .836 | 700,000 | 500 | 760 | .0143 | 2,120.0 |
| .... | .895 | 800,000 | 550 | 840 | .0125 | 2,422.0 |
| .... | 1.000 | 1,000,000 | 650 | 1,000 | .0100 | 3,028.0 |
| .... | 1.095 | 1,200,000 | 730 | 1,150 | .0084 | 3,635.0 |
| .... | 1.180 | 1,400,000 | 810 | 1,290 | .0071 | 4,240.0 |
| .... | 1.224 | 1,500,000 | 850 | 1,350 | .0066 | 4,545.0 |
| .... | 1.264 | 1,600,000 | 890 | 1,430 | .0062 | 4,840.0 |
| .... | 1.342 | 1,800,000 | 970 | 1,550 | .0055 | 5,450.0 |
| .... | 1.413 | 2,000,000 | 1,050 | 1,670 | .0050 | 6,056.0 |

For insulated aluminum wire the carrying capacities are 84 per cent of the above values.

about unity, but where motors are used the power-factor may be anywhere from 65 to 75 per cent, and a system on which both lamps and motors are used may have a power-factor of 80 to 90 per cent. The difference between the power-factor and 100 per cent represents the percentage of energy that is not being put to use. If a single-phase motor takes 7 amperes at 110 volts, as measured by a voltmeter and ammeter at the motor, or 770 apparent watts, it does not necessarily mean that it is developing a trifle over one horsepower. If the power-factor of the motor is 80 per cent, the real energy is only 7 times 110 times 0.8 or 616 watts, which is less than one horsepower. Besides this, there are, of course, small losses in bearings, windage, etc., which are found in all types of motors.

By multiplying by 746, the horsepower of any motor is reduced to watts. Then if the wattage is divided by the quantity obtained by multiplying together 1.732 and the motor voltage, efficiency and power-factor, the result is the current per lead for a three-phase motor. In the case of a two-phase motor the process is the same, except that 2 is used in place of 1.732 in the second multiplication.

Aside from the fact that the conductors to the motor and the motor also require proper fuse protection, the leads must be of sufficiently liberal cross-sectional area for alternating-current motors. The current taken by a squirrel-cage motor is large at starting and will cause a greater drop in voltage with small wires. The starting torque of the motor will therefore be decreased because it decreases with the decrease in voltage supplied.

It has been found necessary in some localities to issue specific instructions regarding the size of conductors, fuses and switches for use on alternating-current motor systems. In many cases the leads required are of 100 to 150 per cent greater capacity than the rated current of the motor. As stated before, the leads can be fused at the weather-proof insulated-wire capacity rating.

The ampere-per-phase rating found on the nameplate of motors is often somewhat less than the actual current taken at full load, and this should be taken into consideration also in determining the size of conductors. For all practical purposes in the industrial plant or factory, leads to the motors—if squirrel-cage—of 100 per cent greater carrying capacity than the rated amperage or 150 per cent greater for severe cases will be satisfactory and will be large enough to allow for all ordinary lengths of runs and for all commercial power-factors. With conductors selected in this way, drop need rarely be considered. For single-phase motors and polyphase motors of the slip-ring type the leads need only be of 40 to 50 per cent greater capacity than that for which the motor is rated.

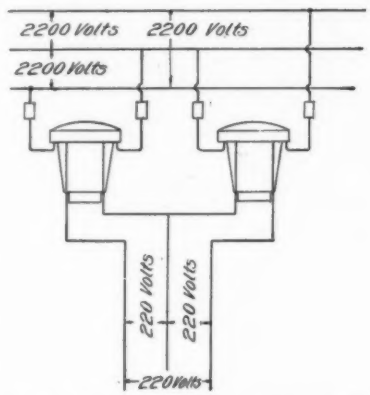



Fig. 3.—Two Transformers Connected in Open Delta on Three-phase Circuit.

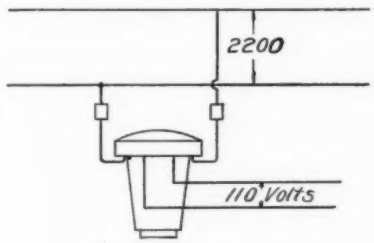



Fig. 4.—Method of Connecting Single Transformer to Line.

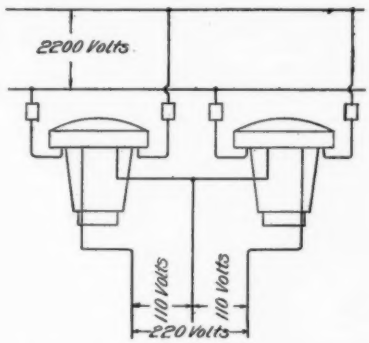



Fig. 5.—Two Transformers with Secondaries in Series to Supply Three-wire Service.

### Transformers.

As with all alternating-current systems transformers are used, it is well to note a few facts about their use and installation.

A transformer consists of two separate windings, a primary and secondary, and its practical utility lies in the fact that the primary can take electric energy at one voltage, say, 2,200, and deliver the same energy through the leads from the secondary at another voltage. Step-down transformers are of the above type; step-up transformers change from a low voltage to a higher one and are used mostly in central-station power houses or substations.

Single-phase transformers for lighting service are often mounted on poles and are connected as shown in Fig. 4. Three-wire single-phase, 220 to 110-volt circuits are used in residence districts and the connections of the transformers are as shown in Fig. 5. The transformers indicated here are both single-phase types; that is, they have one primary and one secondary winding. For three-phase and two-phase motor circuits, single-phase motors are also used, although three-phase transformers are beginning to be used more extensively. In supplying three-phase service for motors in industrial plants, the arrangement of two transformers in open delta as shown in Fig. 3, is frequently employed. The same result is obtained with two transformers of somewhat larger size as with three connected in delta. The advantage in using three is that in case one is burned out or if a primary fuse blows the other two can carry the load and provide three-phase current as before without interruption.

Because of the low-power factor of induction motors, transformers supplying current for their operation are selected of a higher capacity than that of the motors. The customary practice is to have the kilowatt capacity of the transformers equal the horsepower capacity of the motor or motors.

| Motor Load in Horsepower. | One Transformer, Size in Kilowatts. | Two Transformers, Size of Each in Kilowatts. | Three Transformers, Size of Each in Kilowatts. |
|---|---|---|---|
| 5 | 5 | 3 | 2 |
| 15 | 15 | 8 | 5 |
| 25 | 25 | 13 | 8 |
| 30 | 30 | 15 | 10 |
| 40 | 40 | 20 | 15 |
| 60 | 60 | 30 | 20 |
| 80 | 80 | 40 | 25 |
| 100 | 100 | 50 | 25 |

For industrial plants, factories and loft buildings the transformers are sometimes mounted on poles, on a platform outside or directly on the wall outside the building. But at present central-power stations sell considerable current for power purposes at wholesale rates. The current is delivered three or two-phase, 2,200 volts —11,000 sometimes—and the transformers in this case, being the property of the customer, are placed inside or in small roof rooms. A small brick or concrete house built in one corner on the roof of a building is good for city plants, as no extra ground space

need be used. A cement floor is put in the room with a drain for carrying off any overflowing oil and a vent is provided to prevent the accumulation of explosive vapors generated by hot oil. The vent also keeps the room ventilated and the transformers cool and makes possible the carrying out of smoke in case of a burnout, or any burning of transformer oil or insulation. The high-voltage primary oil switch, circuit-breakers for cutting off all the current, lightning arresters, wattmeters, etc., are all mounted in this room and the conductors going to the main plant carry only the lower voltage. A trap door, metal lined, is so arranged that no oil can leak through to the floor below.

The transformers, some of which are for supplying the motor circuits and some for the lighting are often set on oil-filled timbers 10 inches from the wall and about 10 inches apart, although it is good practice to bond the cases and ground permanently. The wires to the transformers from the switchboard can be supported 8 to 10 inches apart on glass petticoat insulators and where there is much wiring it is best to use wire with a slow-burning outer braid.

The primary wires, which are rubber-covered from the insulating supports outside the room to the switch, are brought directly to fuses mounted on the wall and then pass to the oil switch or combined oil switch and circuit-breaker on the switchboard. From the switch they pass through the meters and to the transformers. The secondary wires from the transformers are brought to the switchboard.

The transformers house is also frequently a little building apart from the main buildings and sometimes is a fireproof room built of cement, brick, tile, and the like in one corner of one of the buildings. One wall should be an outside wall to permit of receiving the high-voltage current, unless the service is supplied from an underground system. The door leading to the plant should be a standard fire door and should be locked. The National Electrical Code requirements for transformers on systems up to 5,500 volts are as follows:

"Must be located as near as possible to point of entrance of primary high tension wires. Must be placed in an enclosure built of fire-resisting material; the inclosure to be used only for this purpose, and to be locked and access to same allowed only to responsible parties. Must be thoroughly insulated from the ground or permanently and effectively grounded The inclosure must be practically air-tight and be ventilated to outdoor air through a flue or chimney. There should be at least six inches of air space on all sides of the transformers."

The cases of oil-cooled transformers should not be filled above the level specified by the manufacturers for if filled too full, the oil may become ignited and boil over, producing a spreading stubborn fire. Water is of little use for extinguishing transformer fires, smothering with sand or other dry power is better for the purpose. A few pails of sand or a dry powder mixture—used considerably in the New England states—should be placed in transformer room. The mixture consists of bicarbonate of soda and red or yellow ochre (iron oxide) in the proportion of nine to one. This can be kept in covered metal cans.

## Arrangements for Contractors' Convention.

Arrangements have been completed for twelfth annual convention of the National Electric Contractors' Association, which will be held at Denver, Colo., July 16 to 19, and reservations already made indicate a larger attendance than ever before.

Aside from the meetings, which are always of great interest to the electrical fraternity, the Sons of Jove will be largely represented, and a monster rejuvenation will be held.

Side trips will be made over the Moffat Road, the Georgetown Loop, to Pike's Peak and the Garden of the Gods, and automobile trips in and around Denver. In addition to these, a special party is being made up for a visit to the Yellowstone National Park.

Special low rates have been obtained, and private cars from Boston and New York will be attached to the special train from Chicago. Complete itinerary giving dates, railroad and Pullman fares, together with descriptive matter of the scenic roads will be mailed on request by the master of transportation, V. C. Gilpin, 41 Gardner Avenue, Brooklyn, N. Y.

Five days will be spent in the Yellowstone National Park, which includes 150-mile stage trip in Concord stages.

## New List of Approved Fittings.

The revised List of Electrical Fittings which is issued semi-annually, in pamphlet form, in connection with the work of the Underwriters' Laboratories and distributed among electrical contractors, inspectors and any others interested, is expected to be ready for distribution toward the end of the present month. This booklet is supposed to make its appearance regularly in April and October, but conditions are sometimes such as to necessitate delay in its publication.

The recent modifications in the National Electrical Code will be published either with the new List of Fittings or in a separate pamphlet, it is stated.

## INSTALLING CONDUIT SERVICES.

By George L. Forrest.

The use of electric service entrances in conduit is rapidly displaying the older method of knob-and-tube or open work and with good cause. Aside from the advantages of the former method, such as freedom from fire hazard and rendering current theft difficult, the actual cost of installing compares very favorably with the older methods when a little time and thought are given to the development of a proper system of installation.

In order to standardize all service

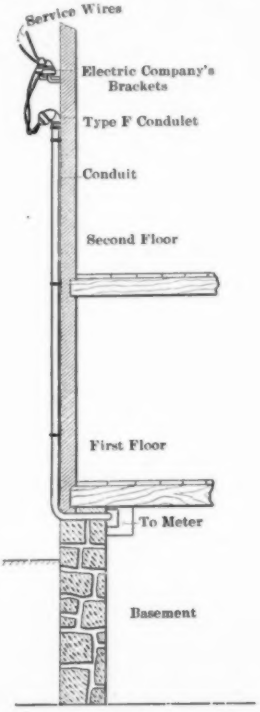



Fig. 1.—Conduit Service of the General Type Considered in this Article.

entrances, it is best to drill all cutout boxes for service pipe as soon as a shipment of boxes is received, at which time this can be done more economically than on the job. We accomplish this by simply enlarging the upper left-hand hole, which is already punched in the box for fastening, to three-quarters inches in diameter, thus making it large enough to receive the conduit.

To fit and try repeatedly in order to erect service pipe satisfactorily is unnecessary and a waste of time. I will try to point out in these notes and with the help of illustrations, why this is so. It should be understood that what follows applies to half-inch conduit, the size of which in the large majority of installations is ample to

accommodate the service wires used.

After determining the location of service box and meter in the basement, drill a three-quarters-inch hole straight through to outside of building by means of a brick drill or wood bit, according to class of construction encountered. Having determined the proper height of pipe, bend a weather drip on the outdoor end and insert service wires, leaving sufficient surplus on one end for line tap and on the other for main line switch connections. Service pipe should now appear as in Fig. 2. Now insert through the hole in the wall, as in Fig. 3, sufficient length to enter the cutout box and receive a locknut and bushing. Box should now be securely fastened to the wall.

Fig. 4 shows the next operation on outside of building. The pipe is grasped as shown, and with upward pressure on the inside hands and downward pressure on outside band the bend is accomplished as illustrated. It is now only necessary to bend upward at the point represented in the picture by the extreme outside hand.

This will cause the pipe to fit snugly to the building its entire length. Fig. 5 shows all bends of the pipe after this has been done.

It only remains to fasten the pipe securely to building and the job is done. With a little practice, this method of installing is accomplished very rapidly and with a minimum of exertion as half-inch conduit can be bent very readily by two men using the holds shown.

Fig. 1 is inserted to show the general character of a completed conduit service. While the size shown in the figure is bent in a somewhat different manner, the service illustrated is essentially the same as that contemplated in the foregoing notes. Location of the meter in the basement with a continuous run of conduit extending from where the wires first reach the wall outside the building to the service cutout is easily the best service entrance for overhead distribution. Joints in the wires should be avoided.

Fig. 2.—Conduit When Weather Drip Has Been Formed.

Fig. 3.—First Step in Bending Lower End of Service Conduit.

Fig. 4.—Second Step in Bending Conduit.

Fig. 5.—Pipe With Completed Bends.

## A SHOP AND OFFICE SYSTEM FOR ELECTRICAL CONTRACTORS.

By E. M. Raetz.

The following is a description of a system from which all unnecessary work has been eliminated as far as possible, and one which is complete enough to furnish an accurate check on the condition of the business of the electrical contractor. This system is now regularly used in a shop in a city of eight thousand people, where there are seven men employed, and which does a varied business including conduit and fixture work, open wiring and all kinds of repair work. The firm also has a good electrical store business.

The method of charging labor and material will first be taken up. This business will not stand the expense of a high-priced foreman, and so the proprietor has all outside work in hand and is always in touch with practically every job that is being done. A boy, who has been with the company for three years, is in charge of the stock at the shop and also of sundry repair work such as that on flatiron cords, etc. He also gets out material for jobs and has it ready. In fact, he often delivers it at the place where the work is going on.

When a call comes in for a job of wiring, the proprietor goes to the location of the work, and if it is a contract, he makes up an estimate and submits it right on the grounds. If it is to be done on a labor and material basis, he takes notes of the material required and writes up a brief description of the work, which is handed to the next man who comes in from another job. He has to exercise some judgment, of course, in sending men out on various work, since some of his men are better qualified to do certain jobs than others. Before the man is sent out, the stock list—which is written on pads of common sales books, which cost 25 cents a dozen and with which all the men are kept supplied—is given to the stock boy, who gets out the material and has it ready for the man, or sends it to him on the job, whichever is deemed most expedient in the case in hand. All material is charged before it leaves the shop, and any additional material found to be necessary as the work progresses is called for, charged and sent out in the same way. When the job is finished, all unused material is brought back and a credit slip is made out for it. This slip is marked "credit" and is then handed in.

Each job, except small ones and repairs, is given a number and a letter designation. Contracts are styled "C" jobs; extra work on a contract is called an "X" job; labor and material jobs are classed "J" orders; and shop time for one month is known as "E" order. The jobs being numbered consecutively as they are received, each one thus has its own letter and number. A job record is kept in the shop. This has all the job numbers and letters and also the name of the customer in each case, and it likewise states what the job is—that is, whether it is house wiring, motor wiring, fixture installation, or work of still some other kind.

Besides the regular day book and ledgers there is a loose-leaf "job" book. In the front of this there is a record of the jobs like that posted in the shop. The loose leaves on which the labor and material are charged are consecutively numbered. The first page of each job charge is headed with the customer's name, and the job number and letter are written in the upper right-hand corner. If it is contract work, the amount of the contract is stated. If it is a time and material proposition, the material is listed each day as it is taken out and when the work is finished the credits are entered in red ink and subtracted from the charges; and then the amount of material used is entered directly on the journal side of a Baker-Vawter ledger-journal, which duplicates the invoice while the entry is being made and leaves a carbon copy of the invoice in the journal and the ledger page on the opposite side, on which any customer's account can be instantly determined. Anybody who has pawed over the old-style journals and ledgers will appreciate the rapidity with which the book work can be done on an up-to-date loose-leaf system of this kind.

After the material and labor are thus charged to the customer on the journal, the sheets are removed from the job book, and all charge tickets and credit tickets are placed in an envelope and filed away in a "completed job" file under the customer's name. Thus the original shop records are easily available in case it should be necessary to refer to them at any subsequent time. Any contractor who has handled some six hundred accounts per month and entered on each one of them an average of from ten to a dozen items, knows without being told what a number of little things may come up so as to necessitate his having all these data within easy reach.

The job book referred to consists of two stiff covers of such size as to take journal-ruled foolscap paper, and these sheets are held in place by four rings, the sheets being punched to receive the rings. For small jobs where there are only a few items the sheets are cut in half.

In pricing material and labor on the job-book sheets, one column can be used for costs and the other for the selling price. This makes the matter of figuring the net profit very easy.

The sales books employed to make charges and credits on are the little, cheap ones which grocers use. The pages are three and a half inches wide and five and a half inches long. These are also used by the men in keeping their time.

A carbon copy of each time slip is required of them, one slip being kept by the workman and the duplicate going to the office. By the use of these, each man's time is checked up at the end of each week. Moreover, each man is required in turning in his time to make out a separate time slip for each job he works on, so that the time slips can be filed with the material slips when a job is finished.

A time book is also kept, in which each man's time is recorded every day. The time slip is given two check marks, one to show that the time has been credited to the workman in the time book and the other to indicate that the time has been duly charged to the job. The pay roll is made up from the time book, of course, and the week's work ends Friday night so far as the weekly payment of the men is concerned, time being thus left to compute the pay roll on Saturday morning.

For small jobs and repair work, material and labor are charged on the same sheet of the sales books, so as to reduce the number of slips to be handled. From these the jobs are charged on the day book, and the slips are then filed away alphabetically.

For keeping the cost record of the goods handled in the shop and store, a card system is employed. By using cards about ten inches wide and twelve inches long the number of cards which must be kept is prevented from becoming excessive. As many articles whose names begin with the same letter are listed on one card as is consistent with clearness. Each article is listed as follows: There are five columns on a line; in the first of these is the name of the article, in the second that of the company from which it was purchased, in the third the date of purchase, in the fourth the quantity, and in the fifth the net price per unit. The contractor is enabled by this system to keep a check on his requirements for a year, the variations in the market, and the best quantities in which to buy. After we had installed this card system we found that we had been paying about four different prices for the same article sometimes.

It should be explained, however, that it is not desirable to enter on these cards all articles handled, since this would mean running a general supply catalog.

# Dollar Wiring Kinks.

**Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.**

### Removing Boards from Floor.

In wiring an old house, I notice that many wiremen when taking up floors put a chisel or some such tool between the floor boards and pry them up, thus smashing the edges of the boards so they cannot be repaired. To overcome this I have used the following method with great success: Take a No. 14 wood screw two inches long and saw off about half an inch from the small end with a hacksaw and leave it flat without a point. I keep this in my kit, and when I want to take up a board I set all the nails in as far as possible and then drill a small hole in one end of the board and start the screw in. When it strikes the floor underneath, which is not drilled, it will go no farther, and hence it gradually raises the top board up till it is high enough to get a hammer under it.

E. W. Dullea.

### Quick Way to Mount Switch Boxes.

The best way to mount switch boxes is to insert a six-inch header between the studs and then cut out the size of the box. To do this quickly, prepare a template of one-eighth-inch or three-sixteenth-inch fiber, two and one-quarter inches wide and three and three-sixteenths inches long. Then go over the job and put in all the headers; make the rounds again and mark the size of the boxes, using your template; then make another trip and cut out the holes and mount the boxes, using three-quarter-inch No. 6 screws and a ratchet screw driver. A quick way to cut the hole is to bore a hole at each upper corner and saw down the sides; a sharp blow with the hammer will break out the wood to the approximate size. The template will last a long time and is inexpensive. Time can be saved by making several trips over the job, unless the switches are far apart.

R. E. Smith.

### Connections for Ground Detector.

In the substation where I was employed, we desired to connect two lights over the switchboard in such a way that they could be used either for lighting the panel or for indicating grounds on the station lighting system. We accomplished the desired object by the use of a six-point receptacle and a four-point plug, the receptacle and lamps being connected as shown in the diagram. Consider the circuits, for example, with the plug in Position 1. The current will then flow down from the lower of the two mains, say, and a portion of it will pass through the left-hand lamp and reach the other main by way of the wire which crosses the receptacle obliquely; while the rest of the current will flow across the lower left-hand path of the receptacle, then through the other lamp, and finally to the upper main over the same path taken by the current in the first lamp. Thus both lamps get full voltage and hence burn at normal brilliancy.

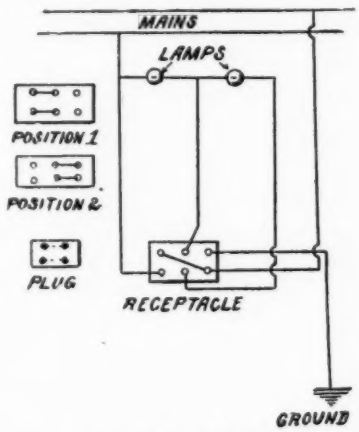



Diagram of Lamp Circuits.

With the plug in Position 2, the lamps indicate grounds. For instance, if the upper main is grounded, current will flow through the lamp on the left, and across the upper part of the plug to ground. A ground on the other main would clearly be indicated by the burning of the lamp on the right.

C. S. Parker.

### Should the Conduit Be Flooded Thus?

On a job that I undertook not long ago I found it impossible to fish an underground pipe from the house to the stable. The pipe was too small and crooked for conduit rods. I took a ball of twine and fastened a cork to one end of it and then pushed the cork a little way into the end of the pipe. I then attached the garden hose to a nearby sill cock and pushed the nozzle of the hose into the end of the conduit. The cork was soon flowed through to the stable.

Charles E. Henney.

### Cutting Large Conduit Straight.

I have a very good scheme for cutting large conduit off straight. In most of the large cities wiremen are compelled to use a hacksaw in cutting conduit all the time, and it is sometimes very hard to make an even job with only a saw. The neatest way is to take a pipe cutter and make a ring around the conduit before trying to saw it. Then the saw will follow the ring readily enough and thus the pipe can be cut off squarely.

J. C. Green.

### Another Way to Fish Wires in Fixtures.

When the electric ways are small and at acute angles, as frequently happens in combination fixtures, and where the ball chain from a pull-socket will not enter readily, I take a piece of linen thread, tie several knots at one end and place the knotted end at the opening. I place the other end of the arm in my mouth and draw air through the same with a quick intake of the breath. The thread will follow the air. Then by tying a loop in the other end, the wires may be placed in the same and drawn in without further trouble.

Julius G. Beyer.

### Stripping BX.

No doubt many a wireman has struggled with the ends of BX after he has cut off the flexible metal armor the usual six or eight inches, preparatory to putting on his fitting. Sometimes the armor comes off very easily, but, with the best makes, I have had, in my early experiences, some trying times. I have seen wiremen untwist first one layer and then loosen up the other layer before it could be removed. I have found the following method very easy:

Cut the outer armor entirely through with your hacksaw and just slightly scar the under armor; then give one or two bends at right angles, and the metals are entirely separated. Then slightly heat the piece it is desired to remove, grasp it with a pair of gas plyers, and it will come off very readily.

Fred Ashton.

### Hint for Installing Flexible Tubing.

In wiring old houses, where flexible tubing has to be used in partitions, one sometimes has trouble in getting the tubing through the five-eighth-inch hole in the plate. I pull the loom up to the hole and then insert a short piece of tubing, allowing this to butt up against that in the partition, after which the latter can easily be pulled through, the short piece serving as a guide.

B. H. Hankins.

# Public Service Commissions

## WISCONSIN.

The Railroad Commission has completed its fifth annual report. During the year ending June 30, 1911, the Commission heard 703 cases, or 61 less than during the preceding year. Of this number, 98 were formal and 87 informal utility cases. The Commission issued a total of 42 decisions in formal utility cases of which 25 were rate cases. At the close of the fiscal year there were pending 63 formal utility cases. It was noted that during the year 34 companies had submitted amended rate schedules which, in nearly every case, amounted to a reduction in rates. A total of 990 plants reported to the Commission as against 946 for the previous year. Of this number, 603 were telephone companies, 193 electric, 54 gas, 126 water and 14 heating companies.

The report reviews the legislation enacted during the year and calls attention to the laws affecting the telephone utilities. Heretofore the telephone business has not been recognized as monopolistic in character in the sense that the electric light and power business is, but a recent enactment has extended the application of the provision preventing the duplication of utilities doing the same kind of business to include telephone companies. In connection with the new law requiring the physical connection of telephone systems when public convenience and necessity demands such connection, it is noted that a test case is now pending to determine the legality of the law and the Commission's jurisdiction in the matter. Attention is also called to the fact that the Stock and Bond Law has been amended so as to include the telephone utilities.

Authority was granted by the Commission during the last year for the issue, by utilities, of $44,624,328 in stocks, bonds and other evidences of indebtedness.

In connection with the Commission's supervision of electric service, 1,395 voltage records were taken, 24 meters were tested for lighting companies, 32 station master meters were tested for accuracy, and 15 meters were tested upon complaint of consumers. Of the last, but 5 were found to register to the prejudice of the consumer. A total of 4,740 telephone test calls were made which showed that 67.5 per cent of all calls were answered in 5 seconds or less and that 87 per cent were answered in 8 seconds or less.

The development of the utility business in the state, as shown in the report, is summarized in the following table:

| | | Per cent Increase. |
|---|---|---|
| **ALL UTILITIES.** | | |
| Plant value | $106,111,174 | 10.07 |
| Bonds outstanding | 45,433,080 | 16.96 |
| Stock outstanding | 48,625,069 | 6.93 |
| Gross earnings | 17,011,280 | 13.20 |
| Gross income available for return to capital | 6,154,468 | 14.05 |
| **ELECTRIC UTILITIES.** | | |
| Plant value | $ 39,429,688 | 22.13 |
| Stock outstanding | 20,177,635 | 18.85 |
| Bonds outstanding | 22,400,307 | 34.56 |
| Total operating revenue | 5,629,103 | 26.68 |
| Income available for return upon capital | 2,171,431 | 24.29 |
| **GAS UTILITIES.** | | |
| Plant value | $ 25,131,512 | 2.06 |
| Income available for return upon capital | 1,466,569 | 5.7 |
| **TELEPHONE UTILITIES.** | | |
| Plant value | $ 16,621,370 | 5.2 |
| Capital stock | 13,260,467 | 0.02* |
| Bonds outstanding | 819,500 | 10.36* |
| Total revenue | 4,566,983 | 9.46 |
| Gross income available for return upon capital | 1,180,209 | 15.90 |

*Decrease.

The report gives the results of two special investigations, the first relating to the degree of compliance with the uniform system of accounts; the second to the practice of electric companies in renewing and inspecting lamps and their method of assisting consumers to secure efficient illumination as required under the service rules. Considerable difficulty has been experienced in obtaining correct reports from the utilities, and the investigation was carried out to determine in exactly what manner the required accounts were being kept. The results showed that considerable work has yet to be done by the Commission before it can be expected that all reports will be satisfactory, as only about one-third of the utilities are conforming in every particular to the requirements of the uniform classification of accounts. The rules of service require that each electric utility shall put into effect some regular system of lamp inspection and shall assist consumers in securing lamps best adapted to that particular system, and also that each electric utility shall inform its consumers as to the conditions under which efficient illumination may be secured. The practice of the various utilities in complying with these rules varies considerably due either to a misunderstanding of the rules or to the fact that managers have failed to work out any plan by which the desired results might be accomplished. The results show that practically no effort is being made to render service to consumers as required under the service rules.

Perhaps the main feature of the report this year is the extra section which is devoted to the statistical summaries and to the unit-cost compilations. Unit costs for the fiscal years 1909, 1910 and 1911 have been compiled for each utility reporting to the Commission.

## NEW YORK.

The Public Service Commission for the First District has awarded the contract for the construction of Section 2-A of the Broadway-Lexington Avenue subway to the O'Rourke Engineering Construction Company, the lowest bidder, for $912,351.60. There are 17 sections of the Broadway-Lexington Avenue subway, and this makes the twelfth for which the Commission has awarded the contract. The total of the contract prices for these 12 sections is $34,050,643.34.

On the application of the New York Railways Company, successors to the Metropolitan Street Railway Company, the Commission has granted a rehearing, to be held April 19, on the order of the Commission, issued February 27, 1912, directing the company to maintain an amortization fund of $108,000 a year, invested so as to produce at least four per cent interest, until the fund shall amount to $16,500,000; and also directing the company to maintain a depreciation fund each month equal to at least 20 per cent of its gross operating revenue. The company asked for a rehearing on the ground that $16,500,000 does not represent the difference between the value of its property and the face value of the stock and bonds issued, and asserts that the property value is greater than such face value. It also contends that the Commission made no allowance for the value of the company's franchises, and asks leave to prove the value of such franchises.

# Legal Notes

## COMPENSATION FOR CONDEMNATION OF PROPERTY.

By Maguire and Mooney.

**In selecting land for condemnation purposes for a central station or a pole line, consideration must be given to the damage done to adjoining property, as well as to the fair valuation of the land itself, as an element in the cost. Any benefits conferred may be deducted from the value of the part of the property taken.**

In exercising the right of eminent domain, two important questions must be considered: (1) whether such right may be exercised, and (2) if it may be exercised, then how much will it cost. The first question was discussed in the previous article, so the cost of condemning property is herein considered.

In seeking to obtain land for the use of transmission lines or for other purposes where it is necessary, the essential point is to secure the land lying in a straight line, thus saving distance, inconvenience and the other detriments attached to a jagged system. In seeking to erect a straight-line system one may be erected cheaper than another, and many matters outside of the actual engineering must be considered. A study of the method of compensating the various owners will invariably save the expenditure of a great sum of money.

The market value of the land that is desired is the first thing to be considered. If a company desires a strip of land a rod wide running through a certain farm the total amount of land to be taken from that farm can be easily computed. Market value, however, is not the value the owner puts upon his land, but it is solely the actual value of the land as compared to the value of other lands in that vicinity. While a certain strip of land may have no market value in itself, because of no actual demand or current rate of price, or because there have been no sales of similar property or the particular piece is the only thing of its kind in the neighborhood, yet, in a general sense, its market value consists in considering the purposes for which the land is suitable.

Value rests merely in opinion, which is the reason that amicable purchases cannot often be arranged with the owners of tracts of land. The fair cash market value determines the value of the property. The value of the land is considered at the time it is taken, and any proposed improvements that might increase the value of the property should not be considered.

The location of the land, the extent and condition of its improvements, its productive qualities, and the uses to which it may reasonably be applied must all be considered in determining fair valuations. The fair value of the property as between one who wants to purchase and one who wants to sell is a good definition of market value; not what could be obtained for it under peculiar conditions, nor its speculative value, nor on the other hand is it to be limited to that price which the property would bring when forced off at auction. It is what it would bring at a fair sale when the one party wanted to sell and the other to buy.

The company wishing to take property must compensate the owner for all inconveniences caused. This includes the increased risk or exposure by fire from the operation of a high-tension transmission line, although this damage is lessened when no buildings are near. The damages would include compensation for probable danger to the stock, crops and fences, but these should be considered only so far as they depreciate the value of the tract. There is always the danger of grounded wires and the danger of wires loosened by storms, all of which could create serious damage to a farm. The reputable company that keeps its system in good condition, allows no wires to remain in an unsafe condition and looks after the welfare of those who are in proximity to any part of the system, must pay practically as much for the risk caused by the installation of their system as the disreputable company that operates in a slovenly manner. And it is only from damage previously done by other companies in other places, or damage reasonably contemplated that the compensation will be figured. The fact that the company desiring the land is a reputable company makes little difference, it must be bound by the rules promulgated to reach poorly constructed systems.

In the previous article on liability in erecting poles in highways[1] the general rule was stated that compensation must be made to the abutting owner, and in erecting transmission lines across country, whether they cross farms or border highways the proposition of compensation must be met.

In addition to compensation being made for the taking of property the benefits conferred on other property must be considered. When a city opens up an alley it must pay for the property actually taken, yet it may charge back against the property adjacent to the proposed alley a certain sum for the benefit of this property by the creation of the alley. And in this manner a public-utility company may charge back certain benefits it renders to the owner of property. Accordingly the supplying of current, or the willingness to supply current to the owner of land condemned, is in itself a benefit which he must be charged with. Before the company sought his land he did not have the opportunity of using electricity, so in determining the amount due the owner on taking the property, a reasonable value for such benefits must be deducted from the reasonable value of the property. Even though the owner will not use electric current, he is in the same position as the owner who will never use the alley; it was created for public convenience and he will have the opportunity of so using it. However, if the line is a competing line and can confer no advantages to the land adjacent to the system there can be no benefit.

One of the methods by which the amount of compensation may be lessened is by laying the system in conduits. This method prevents damage by fire and the dangerous agencies of the current are practically controlled, or are lessened, and little objection can be raised to the detriment such would have upon adjacent land. The only land affected would be just sufficient land to put the conduit in, although the adjacent owners might weakly complain of electrolysis.

In addition to compensating property owners for injuries to property occasioned by the erection of poles and wires or by

1 "Liability of Public Service Corporation in Erecting Poles or Stringing Wires in a Highway," March 9, 1912.

the construction of conduits, the maintenance of a central station or a substation must also be considered. While a great deal of the litigation over public-service stations has been classed as nuisances, yet the rules of compensation are always applicable to condemnation. In the condemnation of property, if it is in the least damaged it is included under the word "taken," even though the company had no intention of damaging it. Accordingly, if an electric power company erects its central station, it is not only taking the land on which its station is erected, but it is taking away a certain right of enjoyment which the adjacent owners are possessed of. It is reducing their full enjoyment of their property and it is a taking. In the case of Hyde Park Thomson-Houston Light Company vs. Porter, 167 Ill., 276, the company had erected its plant upon property adjoining Porter's. He complained that the smoke, dirt and soot that was cast upon his property, the noxious odors that filled the air and the vibration and jarring of his house, greatly damaged his property. The court held that the value of the property was greatly decreased by the operation of the plant and allowed $2,000 as damages.

The great elements of damage in these cases consist in the noise, vibration, odor and smoke, and the more this is reduced in the operation, the less will the damages be. The adjacent property owner need not have objected to the erection of the plant, because the erection of the plant ordinarily could not injure his property. The injury to the property begins upon the operation of the plant, and until then the adjacent property owner has not much of an objection.

In Sherman, Tex., a leading case on this rule arose. A Mrs. Belden and her husband owned a lot in that city, upon which they resided. The Gas & Electric Company constructed its plant on an adjoining lot within about fifteen feet of the residence of Mrs. Belden. Before the erection of the plant their property was worth for the use of a home about $3,000. The plant was run continuously day and night and the vibration caused the walls of the house to shake and rattle. Near the Belden's house were situated an ice plant, a woodyard and a railroad switching yard, all of which might have contributed to the vibration and to the smoke and other injuries. The Beldens contended that they were injured to the extent of $1,500, but the jury considered that $700 was a proper sum. The company did not like this, and an appeal was taken. The upper court, after considering the matter, decided that the rule of compensation was not properly applied to the case, and accordingly remanded the case for a further hearing. The method of compensation in this case should have been to find the market value of the property at the date of the trial, and also what would have been the market value of the property at the same time if the operation of the plant should permanently cease, and to deduct the present market value from the value it would have if the nuisance should be discontinued.

The amount of damage always depends upon the locality in which the plant is erected. If it be erected in a manufacturing neighborhood less damage can arise than if it be erected in a residential neighborhood. There are many localities in every city where a building devoted to creating electrical energy would manifestly have no injurious effect upon the adjoining property, but there are also many localities where such a use would produce great injury and entirely destroy the value of adjoining property as used by the owners.

It is, however, a partial defense to an action for damages for maintaining a large plant where electrical power is generated, that the company carried on its business for the purpose of supplying electric power for the operation of the various street-car and elevated lines of a city, that it complied with all ordinances, and that it used the best appliances and exercised great care. Sherman Gas & Electric Company vs. Belden, 123 S. W., 119.

So, in considering the exercise of the right of eminent domain great care must be taken in fixing the compensation, and in determining the cheapest practical route for a transmission line or the best place to erect a central station. The knowledge of how to arrive at the proper compensation to be paid is the most important in the consideration of the entire right of condemnation.

## Interesting Cases.

USES AND ADVANTAGES OF ELECTRICITY.—The Supreme Court of Appeals of West Virginia, to justify the authorization of the condemnation of private property by electric power, heat, light and traction companies, when for public use, and to show that the public has a direct interest, says that light, heat, and power are essential to the comfort and convenience of the people of a community, and electricity is capable of supplying them. It can be distributed to each member of a community in such quantity as he may need. It may not only be applied in operating street railways, and in the running of large factories, but the farmer can, if he wants to, utilize it in lighting his house, and in operating machinery to saw wood and grind grain for his family and cattle. But it is not necessary that all the people of a community should take a portion of the electric current in order to constitute the use a public one. It is sufficient if each member of the community has an equal right to a portion of it on equal terms with every other member. Again, the court says that, until the discovery of this form of energy, and the invention of means by which it could be transmitted, controlled, and applied, so as to give light, heat, and power, only a limited use could be made of the natural waterfalls which abound in this state. It is not practicable to transmit water power a very great distance, and, in order to utilize the waterfalls as a direct motive power at all, mills and factories would have to be erected near by, and very many of such waterfalls are found in sections remote from railroads. But these waterfalls, however remote from railroad development, may be utilized to develop electricity, which may be transmitted for a long distance. Moreover, electricity is capable of supplying more of man's wants and needs than any other natural force now known. For some, or all, of these different purposes, it is now in almost universal use in every civilized country on the globe. — Pittsburg Hydro-Electric Company vs. Liston, 73 S. E. R., 86.

TRANSFORMER PATENTS.—Patent No. 829,780, issued to Walter A. Hall, in 1906, is declared invalid by the United States Circuit Court of Appeals in the case of the General Electric Company vs. Pittsburgh Transformer Company. This patent covered a substitution of eccentric for concentric coil mounting, and the decision held that the improvement did not constitute an invention but simply the application of general engineering principles by a trained engineer. This decision affirmed that of the lower court. In a suit against the same company by the Westinghouse Electric & Manufacturing Company in the United States District Court for Western Pennsylvania, a decision was handed down for the defendant on February 21. This suit was for infringement of patent No. 469,809, issued to William Stanley in 1892. In this case the court held that infringement had not been proven.

TAXES ON PLANT OWNED BY MUNICIPALITY. — The Municipal Electric Light Company, of Madisonville, Ky., which operates the municipally owned lighting plant, has been sued for back taxes on $50,000 of property by the county. The question of whether municipal property held in the name of another corporation is taxable by the county has never been decided in Kentucky courts, and the point raised is, therefore, an important one.

# Questions and Answers.

**All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within nine days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.**

## Questions.

No. 57. Operation of Moving-Picture Machines.—I understand that moving-picture machines are always run by hand and that motor drive is not permitted. Why is this? Would not a motor drive give a much more uniform speed and therefore produce a more regular and pleasing show?—H. V. N., Columbus, O.

No. 58.—Series Circuits for Ornamental Street Lighting.—Why are most installations of ornamental street lighting with tungsten clusters made on multiple circuits, whereas all other street lighting is almost invariably on series circuits? I should think that series tungsten lamps would give better results than multiple lamps and circuit control would be much simpler.—P. R. J., Evansville, Ind.

No. 59.—Depreciation of Storage Battery After Idleness.—On starting to use my storage battery this spring, after it was idle all winter, I find that its capacity is much reduced. I can get only about 95 ampere-hours out of it now compared to 115 to 120 last fall. The battery was fully charged and carefully covered before being left. It was purchased two years ago and after the first winter did not show any appreciable decrease in capacity. What caused the decrease which occured last winter?—R. C., Belvidere, Ill.

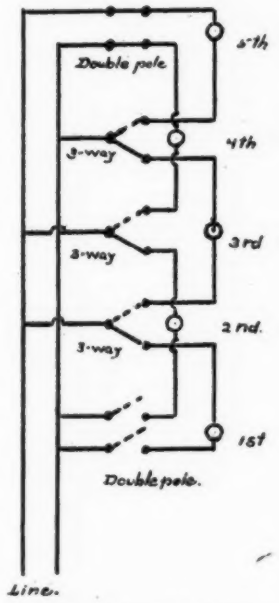
No. 60.—Effect of Wave-Length on Wireless Service.—What is the effect of wave-length on the relative distances that wireless messages can be sent by day and by night?—M. S. V., Ann Arbor, Mich.

No. 61.—Opening Exposition from a Long Distance.—After reading that a prominent man had started the wheels of an exposition by pressing a button over 1,400 miles away, I had a dispute with a man who asserted these stories are pure fakes, that he did not believe it was possible and knew at least one case where merely a telegraphic signal to the operator in a substation had been sent. I contended that a telegraph relay can easily be arranged to control the necessary switches. Was I right?—H. B. D., Faribault, Minn.

## Answers.

No. 46.—Combination Switch for Stairway Lights.—Is it possible to arrange the circuits and switches in a stairway so that as one goes up the stairs he may, by means of a single switch on any landing, turn off the light on the next landing below and at the same time turn on the lamp on the next landing above? If so, what is the proper arrangement of circuits?—J. S. C., Detroit, Mich.

In reading the Electrical Review of February 24, I was especially interested in Question 46 and the solutions printed. The system that was suggested by V. B. is quite unique, but he has evidently made an error in his calculation or in the drawing, for, by tracing the circuits you will see that when a person reaches the fourth floor and turns the switch there, the light below will go out, and the one on this floor will burn, but the one on the fifth



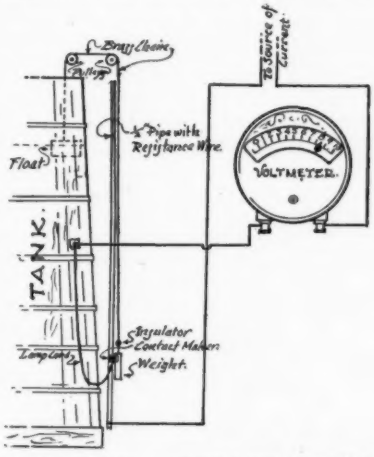

No. 46.—Stairway Lighting.

floor will not light, since there is no return wire. I therefore offer this corrected diagram which will overcome this fault.—H. M., St. Paul, Minn.

No. 52.—Electric Level Indicator for Tanks.—Is there an electrical device for indicating at a remote point the varying height of water in a ten-foot tank?—J. A. S., Montreal, Canada.

[Two answers to this question were published on pages 620 and 621 in the issue of March 30, 1912.—Ed.]

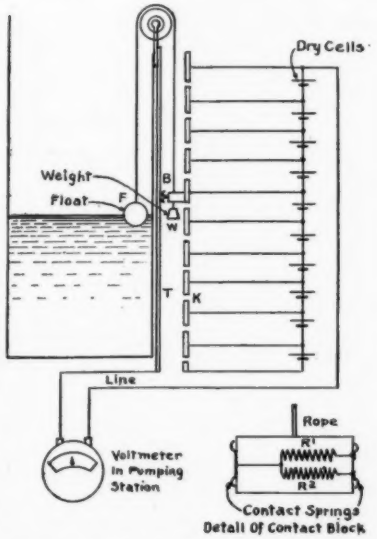
Solution 3.—I do not think there is an electric level indicator on the market, but several years ago I had occasion to make one which has given good service up to the present. I took a piece of gas pipe and wrapped it with one layer of empire cloth and two layers of thin asbestos paper; each layer was stuck on with Sterling insulating varnish. When it was nearly dry I wound resistance wire along the whole length, the turns being about one-fourth inch apart. I then made a float with a contact on the outside of the tank and connected the




No. 52, Solution 3.—Tank-Level Indicator.

whole in series with a cheap voltmeter, the scale of which I calibrated in feet showing the depth of water in the tank. The 110-volt lighting circuit was used to furnish the electromotive force.

This method could be used with batteries which would be preferable to alternating current on account of the direct-current instrument having a more even scale. If batteries are used, the series resistance in the voltmeter will have to be adjusted to the lower voltage, unless a low-reading voltmeter can be obtained. The sketch herewith will explain the connections.—C. T. P., San Francisco, Cal.




No. 52, Solution 4.—Tank-Level Indicator.

Soluton 4.—The accompanying diagram shows a level indicator that will

fill the bill. As the water level varies, the contact block *B* is carried up and down between the two contact surfaces *T* and *K*. The former is a continuous brass strip, while the latter is divided into sections. For a ten-foot tank these may be ten in number, showing the variation in water level in one-foot stages. A single cell is connected between each section as shown. The complications of the contact block are due to the fact that the cells are liable to be short-circuited when the contact passes from one section to another. The resistances $R_1$ $R_2$ are made about 500 ohms each, thus limiting the short-circuit current to a few milliamperes. As the contact block moves up and down the voltage on the voltmeter will vary. A meter having a fifteen-volt scale might be used, in which case the scale could be recalibrated to read directly in feet. A contact might be added at each end of the scale, making a circuit for an alarm bell to indicate high and low water. A meter of the cheapest construction would serve the purpose.—F. M. J. M., Middletown, O.

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No. 54.—Resistances for Shunt-Motor Starters.—How are the resistances for a direct-current shunt-motor starting box calculated? How many contact points should there be? I have in mind building a starter for a five-horsepower, 115-volt motor that runs at 1,200 revolutions per minute.—S. N. T., Kansas City, Mo.

It is necessary to decide upon the maximum allowable current. Then from $I=E/R$, the resistance required to keep the current down to this value can be found. $I$ is the current in amperes, $E$ is the voltage drop across the box, and $R$ is the resistance in ohms. As the motor speeds up, $E$ will decrease due to the counter electromotive force of the motor. The numbers of contact points depends on the smoothness with which it is desired to start the motor. For such a motor as described, I think the following would meet the requirements: a total resistance of 1.56 ohms divided into seven steps, as follows: step 1, 0.65 ohm; step 2, 0.5 ohm; step 3, 0.4 ohm; steps 4 and 5, 0.18 ohm each; steps 6 and 7, 0.1 ohm each. This would give a starting current about twice full-load current.—F. D. K., Schenectady, N. Y.

Unless special service conditions prevail, it is customary to make the total resistance of shunt-motor starting boxes about four times that of the armature. The only thing that limits the initial starting current is the armature resistance. By adding this much resistance in the starter the starting current is made 20 per cent of what it would be without the starter. This usually is amply safe. This total resistance in the starter is divided among the individual coils or resistance units. The number of these is usually six to nine or ten. If the motor is to be started without load, it will come up to speed quickly and a small number of resistance units will suffice; if the motor is to be started when direct-connected to a heavy mechanical load, a larger number of resistance units is desirable. The number of live contact points is one more than the number of resistance coils or units; there should also be a dead or "off" point. In nearly all cases the resistance units are graded, the first few being of higher resistance. For instance, if eight resistances are to be used, the first may be made 25 per cent of the total, the next 15 per cent and the last six each 10 per cent. A no-load release device must be provided.—S. B. E., Indianapolis, Ind.

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No. 55.—Connection of Circuit-Breaker Trip Coils.—On a 2,300-volt switchboard, is it good practice to use oil switches having their automatic trip coils connected directly in series with the high-voltage conductors, or must these coils always be operated by means of series transformers?—J. E. L., Herrington, Kans.

It is common practice on 2,300-volt oil switches with trip coils to connect the coil in series with one of the mains. There is a series trip coil made by one of the largest electrical manufacturers which can be used in this way. There are also trip coils designed and calibrated for use in the secondary circuits of current transformers. Others are made to be opened by relays fed by the secondaries of current transformers whose primaries are connected in series with one side of the line.—S. S. Y., Coffeyville, Kans.

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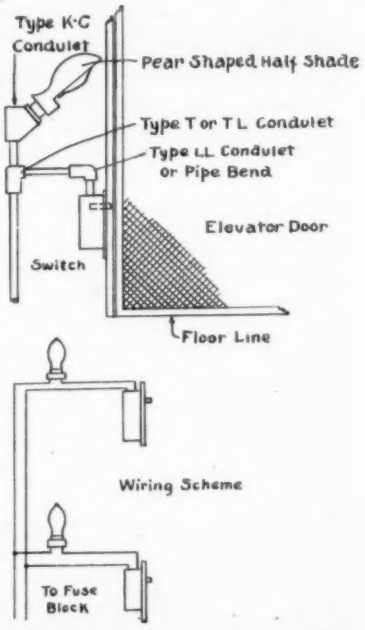
No. 56.—Light for Elevator-Car Threshold.—While visiting in another city recently I saw an interesting device to throw a light on the threshold of an electric-elevator car when the controller was thrown to "off" position. It seems to me it would be still better to have such a lamp light whenever the operator opened the door at any landing, the lamp remaining lighted until the door was again closed. Is there such a device on the market? How could the wiring be arranged?—J. M. R., Oshkosh, Wis.

I would suggest the use of any of the door switches (such as the Diamond H, No. 601) which operates when the gate is entirely closed and lights again when the gate is moved open about three-fourths inch. This is placed in the elevator door casing so that the gate presses on the button when closed and is wired as is any conduit switch.—W. M. P., Seattle, Wash.

The sketch herewith shows the method of wiring for elevator door, the scheme being to cause a lamp, placed a foot or so above elevator threshold and one side of same, to light up when door is opened. A Diamond H door switch, inclosed in a Union box, is set in at the edge of the door so that its button is depressed when the door is closed, the circuit being open under these conditions. Switch No. 601 is best for this purpose. When the door is opened the button is released, thus lighting the lamp. A type KC Condulet may be used for supporting the lamp receptacle, the latter being a Norbit Condulet receptacle with shade-holder groove. A pear-shaped half shade is employed to reflect the light to the threshold. A type E Condulet may take the place of the KC, the receptacle to be a Conduletto with shade-holder groove. In this case the conduit should be bent so that the light will be properly directed. The lamp may be placed within the elevator car, in which case but one will be required. An additional wire would be added to the elevator cable in this case. The door switches are wired in multiple. In the car one wire from the lamp would be tapped to one side of the car-lighting circuit, the other being connected to the additional wire in the cable. The latter, at its opposite end, would be joined to one side of the door-switch circuit, the other wire of which would go to the opposite side of the car-lighting line. A saving of lamps and Condulets would thus be possible where there are a number of floors.—F. M. J. M., Middletown, O.




No. 56.—Lighting of Elevator-Car Threshold.

## SOME NOTES ON CONTROL BOARDS FOR LARGE ELECTRICAL POWER STATIONS.

By S. W. Mauger.

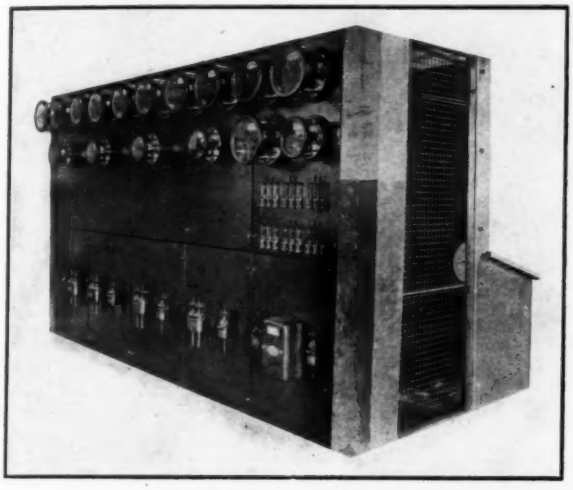
In the early days of switchboard engineering its field seemed somewhat limited, the design consisting of a few instruments, knife switches and fuses, or possibly circuit-breakers, on a vertical panel. The switchboard was purely incidental, and sometimes an afterthought. Conditions have changed—the switchboard now has primary consideration, often before the power house is designed. The switchboard of the modern large power house is not strictly a switchboard in the original sense of the word. The switches are of the remote-control type, the busbars are mounted in compartments or on an iron framework and all located with regard to convenience of wiring and safety instead of operation. Then there is the control board on which is mounted the instruments and control switches, and which might be called the brains of the power plant. The control board, which may be in the form of vertical panels, bench, or pedestal, is designed for convenience in operation and is usually located where the switchboard operator has the best view of the station, although not in all cases.

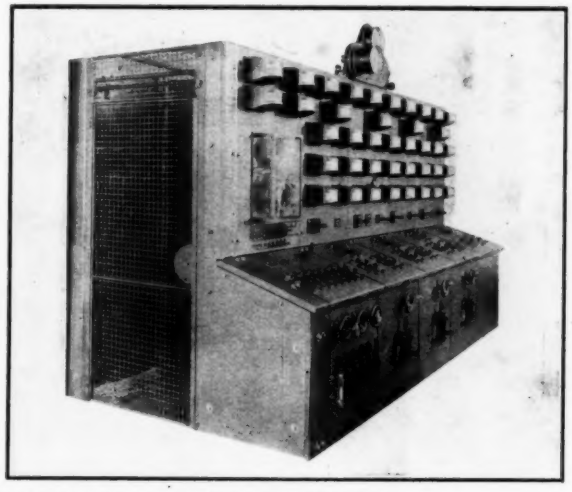
In designing switchboards the first requisite is to decide on the system of connections, the diagram of which should be worked out carefully, taking into consideration all the operating conditions. One fears that this is not always given sufficient thought as in some cases a system of connections is used which is on the one hand too complicated or, on the other, not sufficiently flexible for the service conditions. The design of the control board, as well as the arrangement of switches, depends upon the system of connections and the general design of the station, but it may be said that in the average large power house the switches and busbars are located on one or more galleries running the entire length of the building, and the control board is placed on one of the galleries about midway between the ends of the building. In some cases the switches, busbars and control board are placed in a building separate from the power house.

There are various forms of control boards, the majority being of the bench type. There are also various designs of benchboards, but they can be placed into three general classes, as illustrated in Fig. 5.

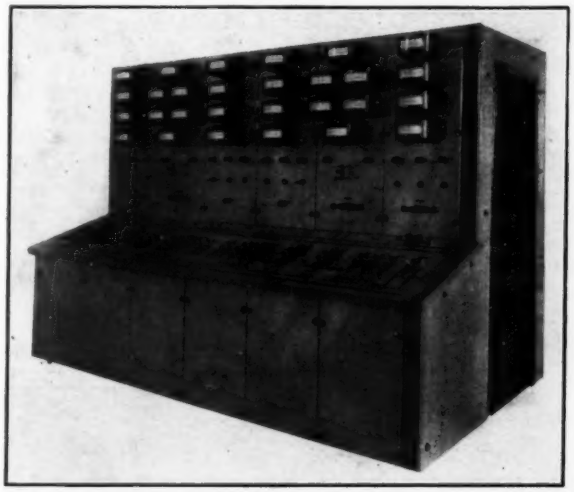
For convenience they will be referred to hereafter as classes A, B and C.

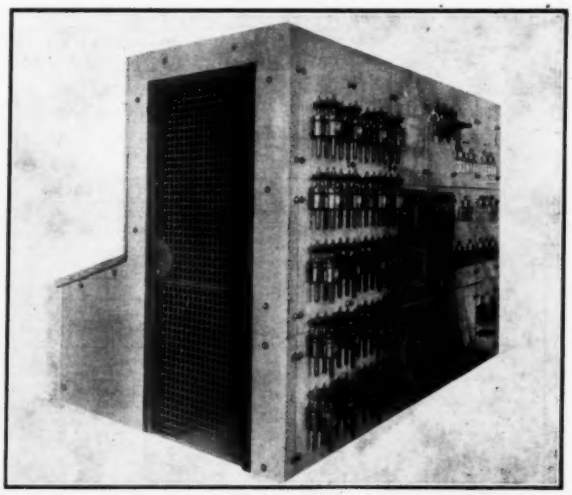
There are general features which are common to all the types referred to in this article, viz: the use of pipe framework, method of ventilating, and general design of the inclined bench. While it would obviously be impossible to standardize complete control boards,





Figs. 1 and 2.—Alternating-Current Switchboard for Fitchburg Gas & Electric Company.





Figs. 3 and 4.—Alternating-Current Switchboard, Baltimore Substation of Pennsylvania Water & Power Company.

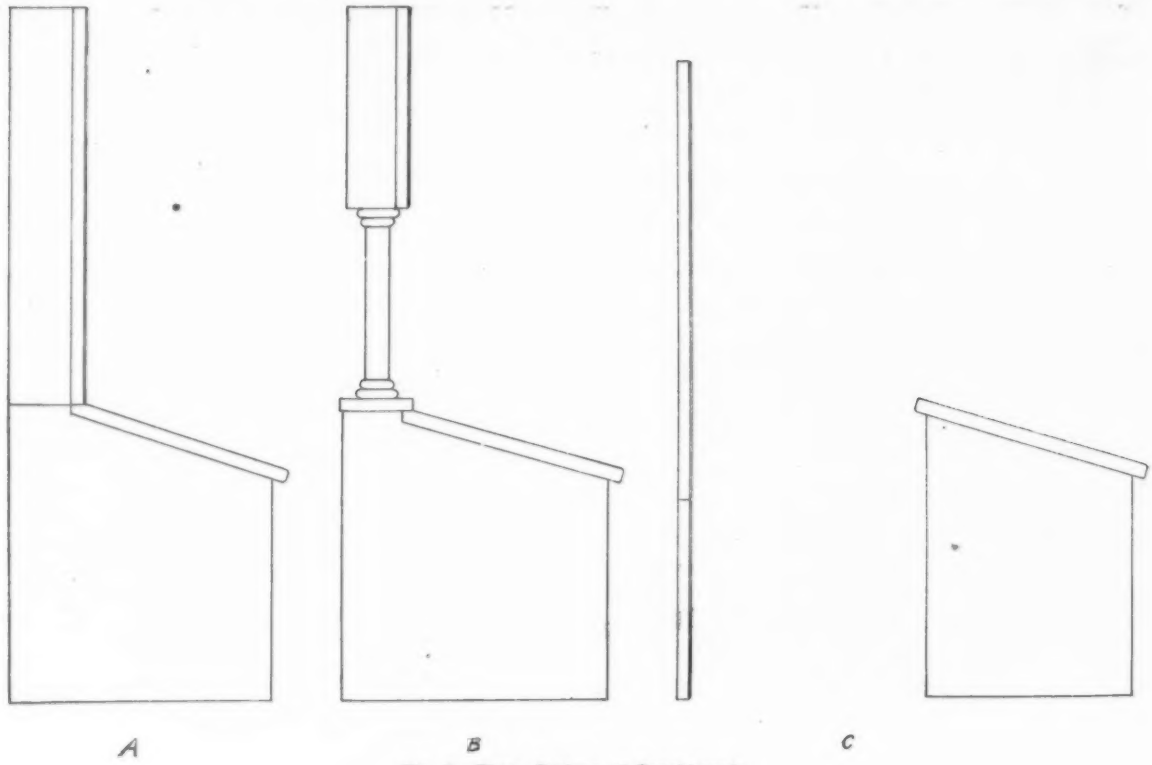



Fig. 5.—Three Designs of Benchboards.

it has been found practicable to standardize many of the individual parts and fittings. Fig. 6 shows some standard units of framework. For ventilating, to take care of the heat generated by the indicating lamps, the colored lens holders on the front of the bench are provided with ventilating holes. The ends or back of the bench are provided with grill-work panels to allow circulation of air. There is also one feature that in the early designs of control boards was not given consideration, but which should always be insisted upon, viz: that the instruments and control switches for a given circuit should be in line so that the operator will not become confused in case of an emergency needing quick action. The control switches should preferably be of a design rendering it impossible to accidently operate the control switch to open or close the main switch. This has been accomplished by using a switch having its contacts on the under side of the slab forming the bench, with pull rods brought through the slab with handles on the top. A person accidently leaning on a handle would not close the contacts, nor would it be pos-

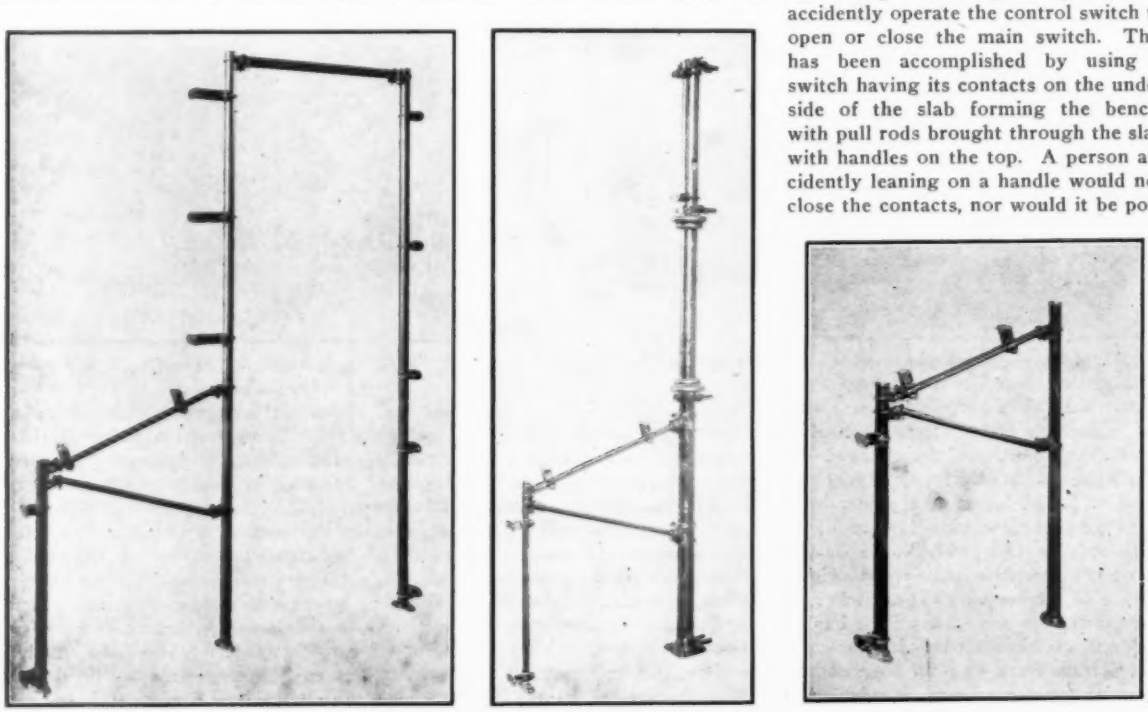


Fig. 6.—Standard Units of Framework.

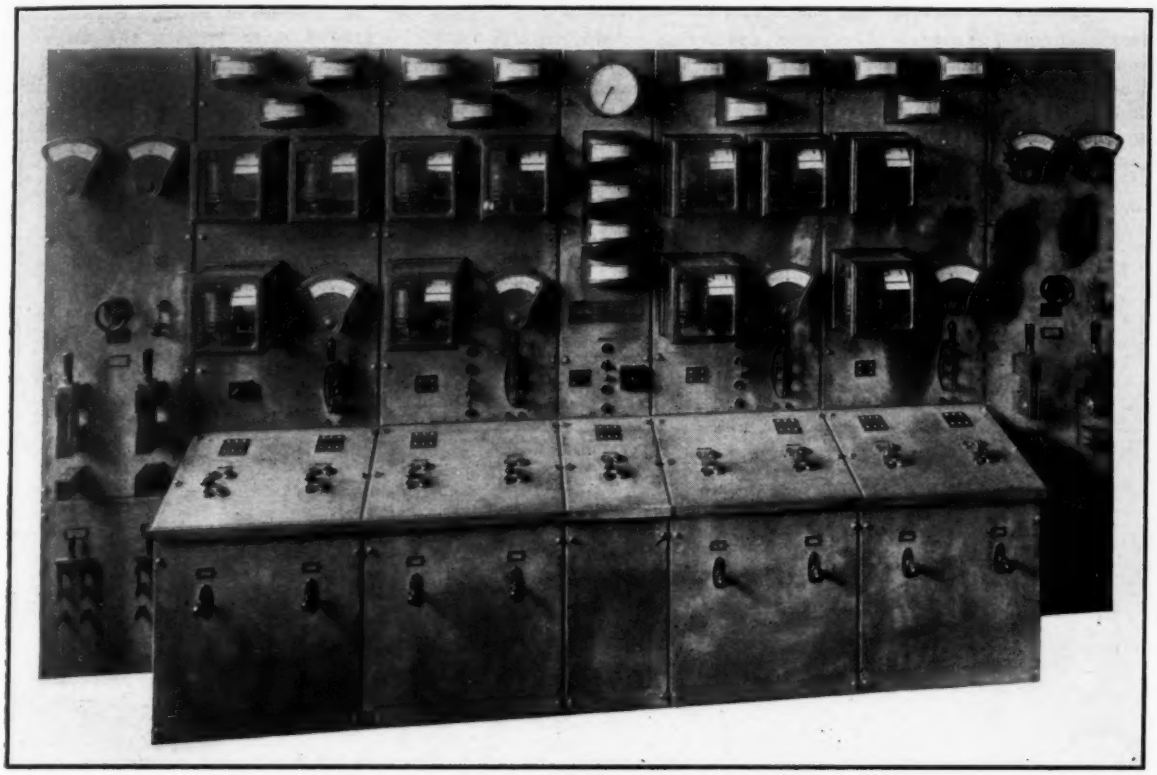


Fig. 7.—Alternating and Direct-Current Boards for Kern River Station, Edison, Cal.

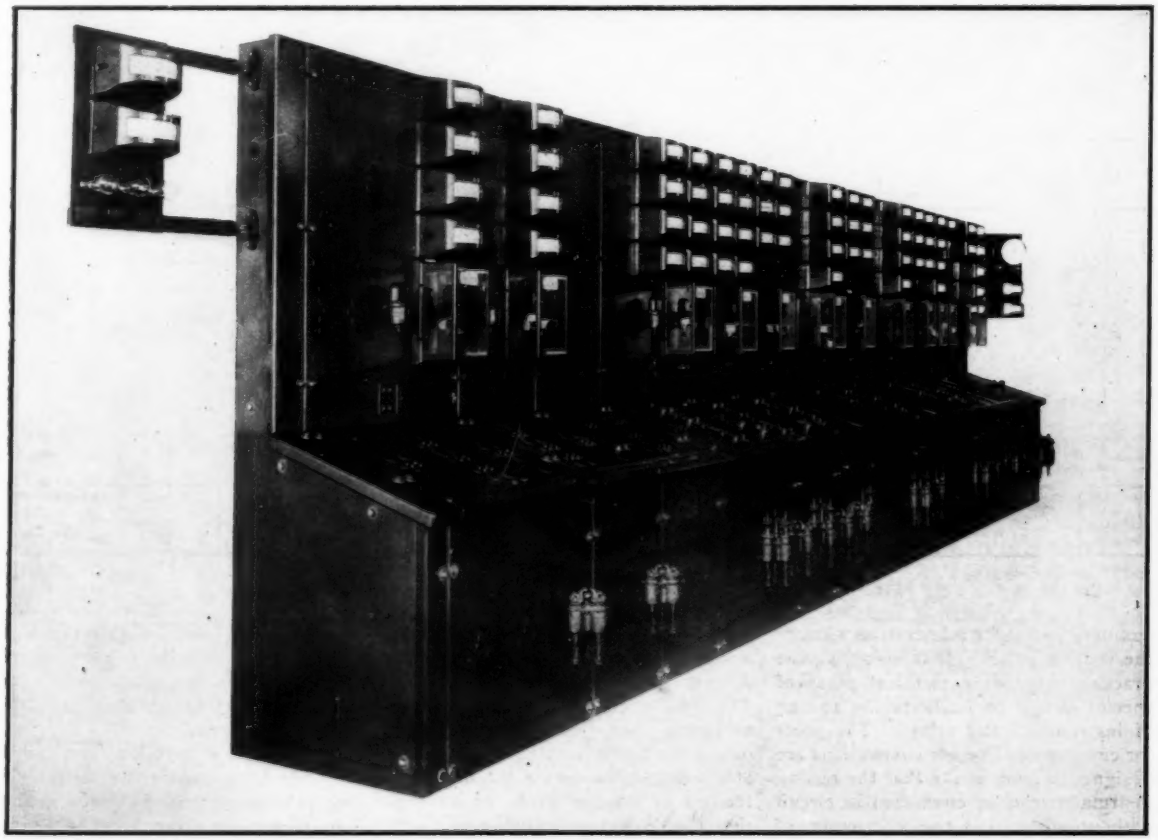


Fig. 8.—Benchboard for Harwood Electric Company.

sible to bridge the contacts and complete a circuit by any metallic piece dropping on the bench. When a switch is used which has its contacts under the bench out of sight, the control wiring should be such as to make the breaking of the circuit to the motor or solenoid operating the main switch, come at some other point such as an auxiliary switch or relay, rather than at the control switch. It is becoming the practice to provide terminal posts of special design to facilitate the testing of instruments and relays. The posts for current-transformer connections are designed in such a way that the testing instrument can be connected in circuit without disturbing the continuity of the circuit. For relay testing and calibrating, arrangements are made for connecting the relay coil to a separate source of alternating-current supply and the relay contacts are disconnected from the main-switch trip coil and connected to a lamp.

For power plants feeding a transmission system with the number of outgoing lines equal to or less than the number of generators, a more compact arrangement can be obtained with class A control board than with the others. The class B control is more applicable to power plants where the feeders go out at the same voltage as the generator voltage, but where the number of feeders is not so great as to make the board excessively long. For power plants feeding a number of substations in a large city with, say, 20 or more feeders, the class C is more suitable. Of course, no absolute rule can be given, various conditions allowing modifications of the above. It is the usual practice to place on the control board copper connections (known as mimic connections), representing the main connections of the power house, and for this reason the system of connections has a distinct bearing on the class of control board selected, as well as on the details of design of the board.

The mimic connections are desirable as they keep before the operator the whole arrangement of circuits, enabling him to see at a glance what is the proper move to make. On the other hand,

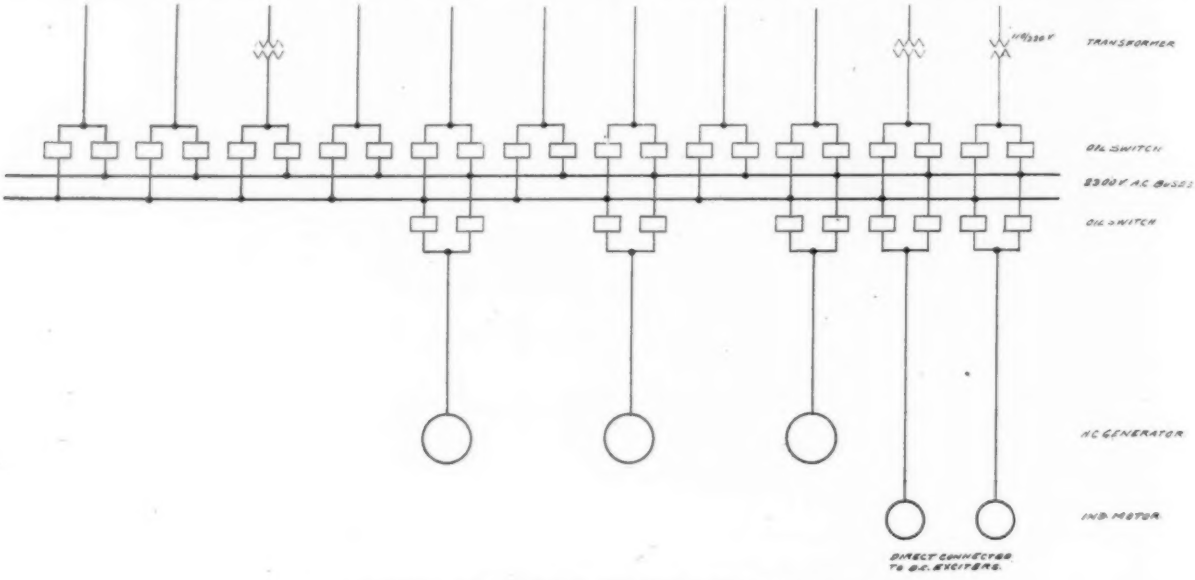



Fig. 9.—Diagram of Connections, Fitchburg Gas & Electric Company.

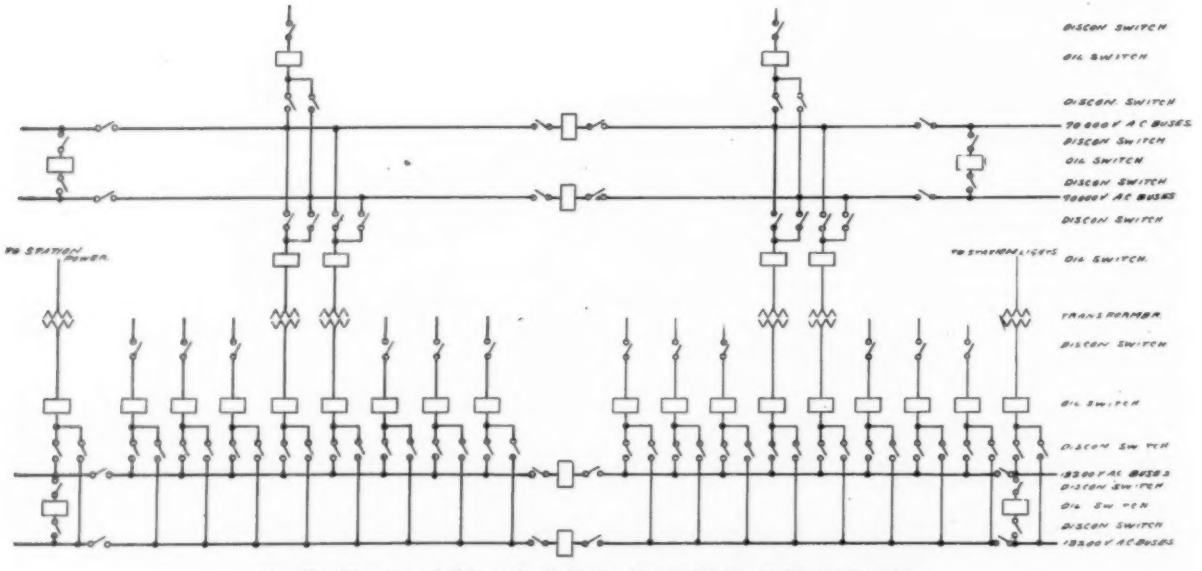



Fig. 10.—Diagram of Connections, Pennsylvania Water & Power Company.

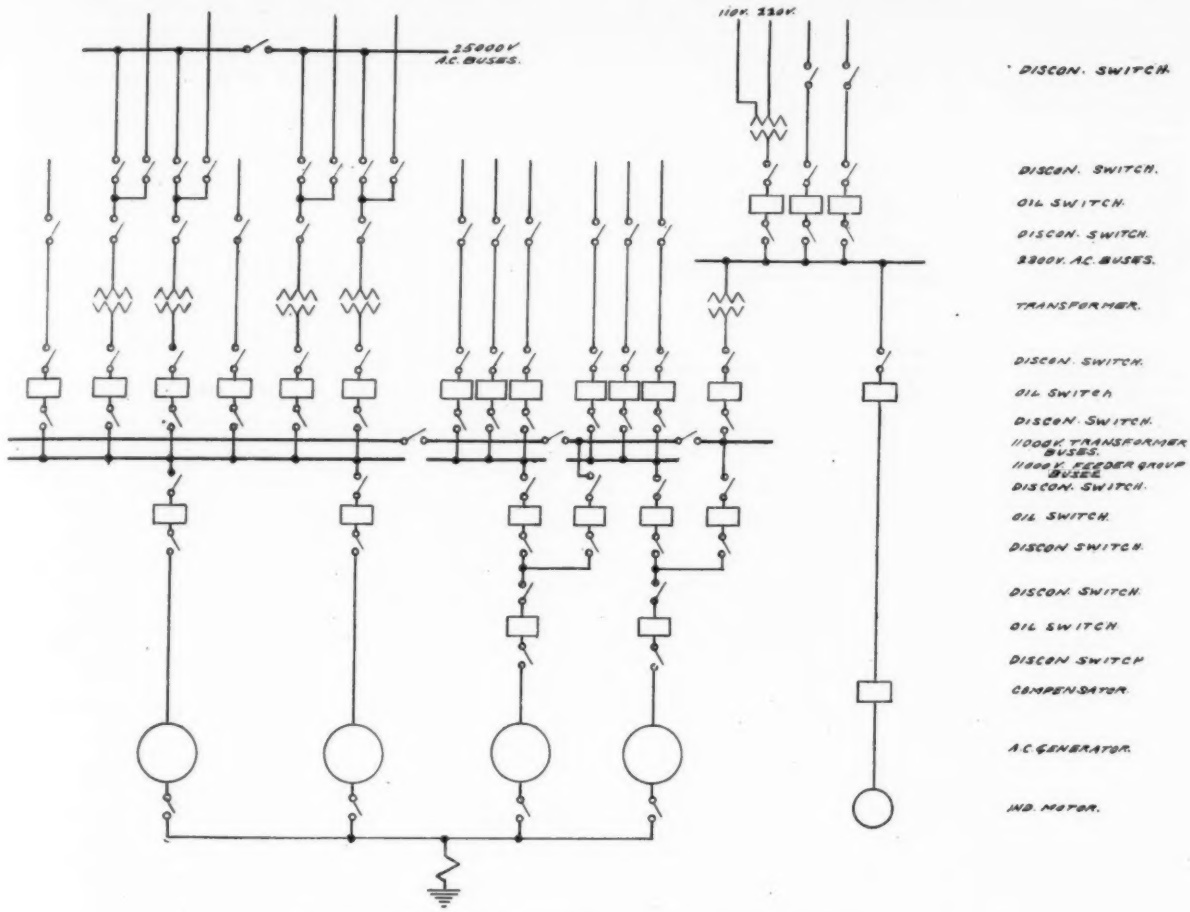



Fig. 11.—Diagram of Connections, Harwood Electric Company.

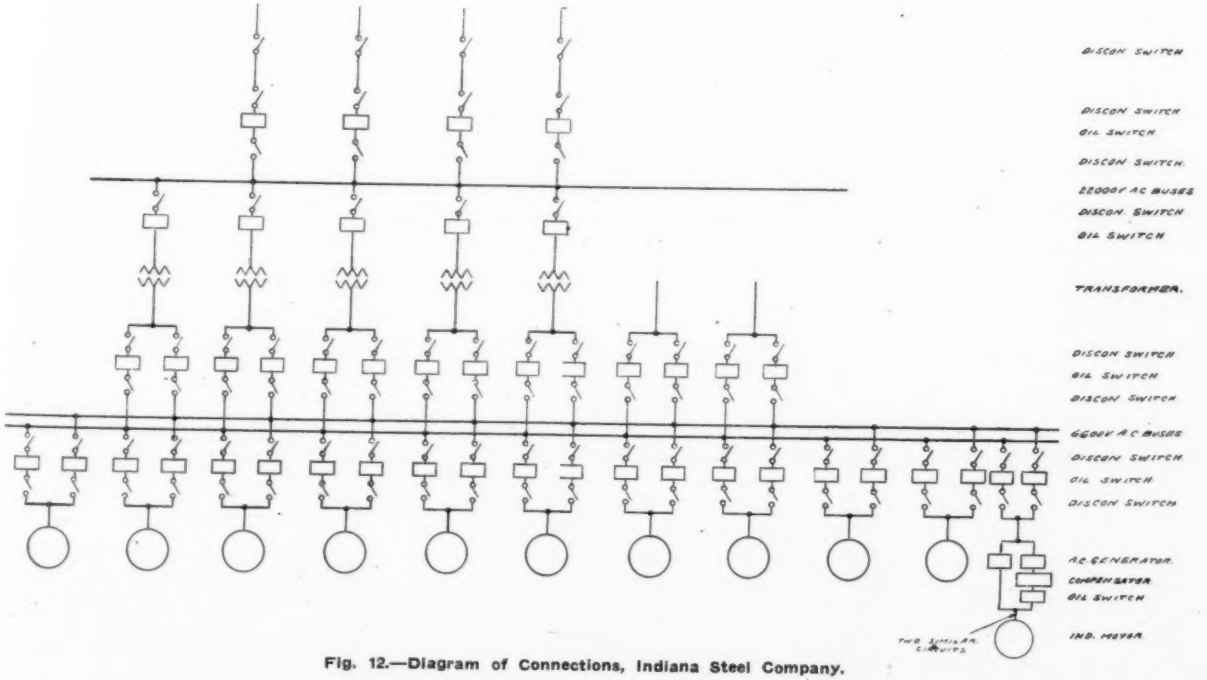



Fig. 12.—Diagram of Connections, Indiana Steel Company.

their use often causes either a crowded or unsymmetrical arrangement, or a larger board than would be required without the mimic bus.

Figs. 1, 2, 3, 4, 7 and 8 show some control boards of class A and Figs. 9, 10 and 11 show the system of connections used in some of the corresponding stations. Class A boards are sometimes built with an inclosure formed by vertical panels of slate or marble at the back and grill work at the ends. One end at least is provided with a door. On the backs of panels are placed the watt-hour meters and overload relays, or whatever devices are not required to be always under the operator's eye. This leaves the front panels and bench for the active indicating instruments and control switches. With this design it is possible to make an excellent arrangement of control and instrument wiring, everything being accessible to those authorized to go within the inclosure.

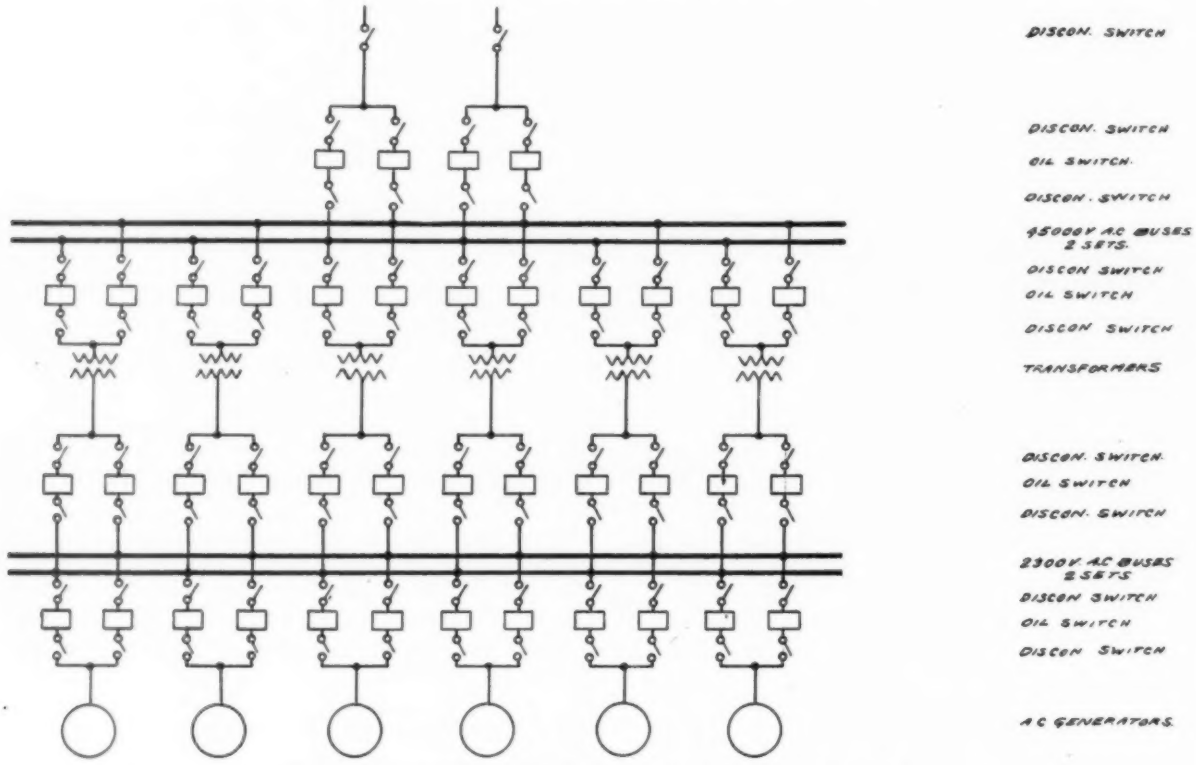



Fig. 13.—Diagram of Connections, United States Reclamation Service.

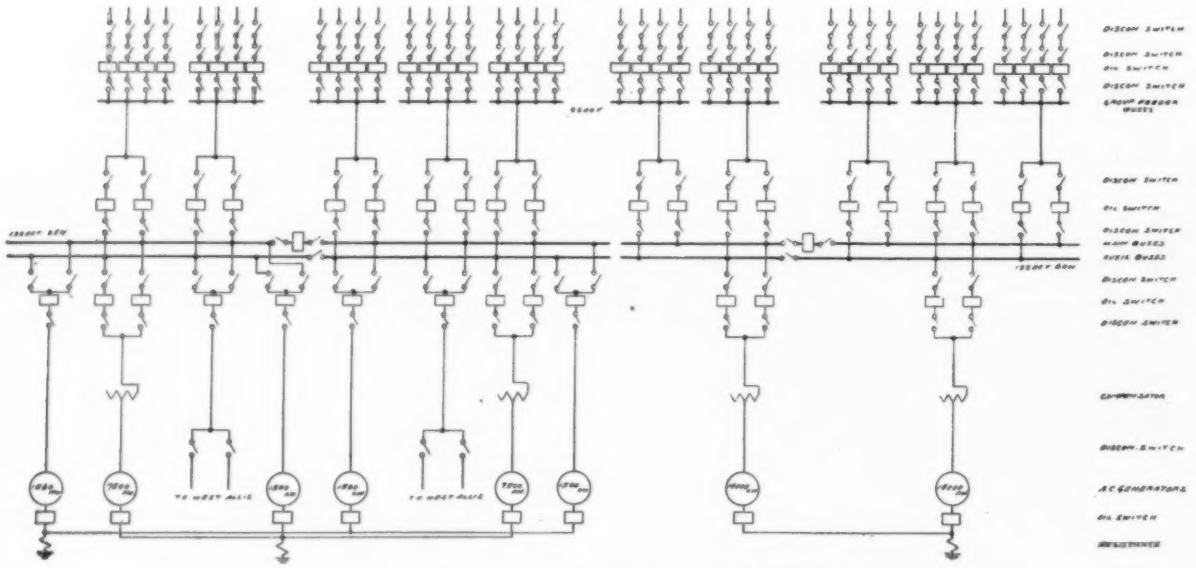


Fig. 14.—Diagram of Connections, Milwaukee Electric Railway & Light Company.

As will be seen from the illustrations, in some cases attempts have been made to provide ornamentation, but the usual practice is to omit such ornamentation.

In the case of the Kern River board

(Fig. 7) the exciter switches are hand-operated and the exciter panels are made part of the control board. In the other cases the exciter switches are solenoid-operated and placed near the exciters, with their control switch and instruments mounted on the control board.

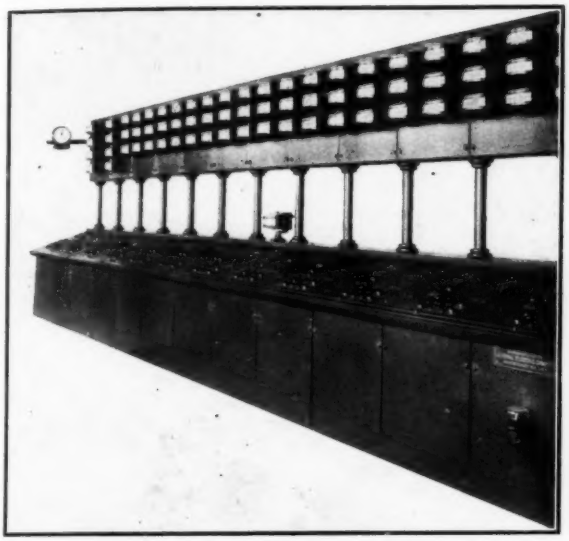


Fig. 15.—Alternating-Current Benchboard of Indiana Steel Company.

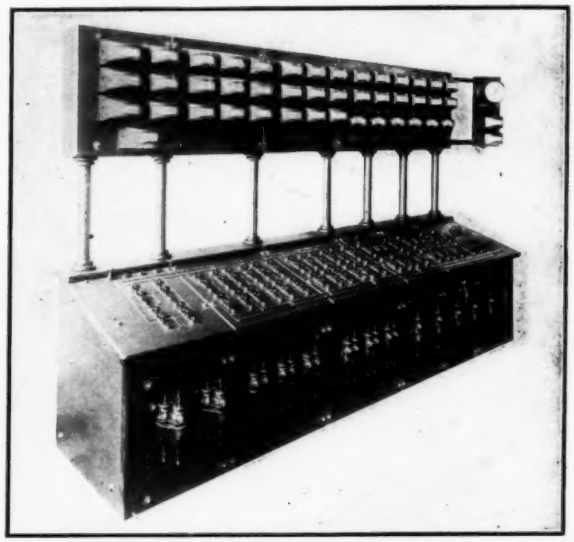


Fig. 16.—Alternating and Direct-Current Board for United States Reclamation Service.

The control board for the Fitchburg Gas & Electric Company is an example of the class of board for a medium-size city plant generating and distributing at 2,300 volts, while an adaptation of board for a large receiving station for a transmission system is seen in the figures showing control board for the Pennsylvania Water & Power Company (Figs. 3 and 4). In several of the figures will be seen blank spaces and also plugged holes; these are to provide for future extensions.

Figs. 15 and 16 show control boards of class B and Figs. 12 and 13 show the corresponding systems of connection. In some installations the class B boards are used only for the generators, the feeders being controlled from vertical panels back of the benchboard so that the operator stands between the two boards. This makes a compact and desirable arrangement, especially when there are a large number of feeders or auxiliary apparatus, such as rotary converters, to be controlled. A greater width of gallery, however, is required for the arrangement, but less length.

With class B boards, relays are sometimes placed on the front panels under the bench, but this should be avoided when possible, as the operator is liable to knock them with his knees. The watt-hour meters are sometimes placed at the back of the bench, facing the station. This requires that the bench be placed a sufficient distance from the edge of the gallery to allow an attendant room to get to the meters to read them. In order that the operator may have a better view of the generators, the gallery is sometimes projected two to four feet from the engine-room floor at the place where the benchboard is located. The class B type of board seems to be the popular one, giving as it does with the least movement of the eye and without the operator leaving his place, a view of instruments and the station. The control board for the Indiana Steel Company (Fig. 15) is a good example of an ideal class B control board.

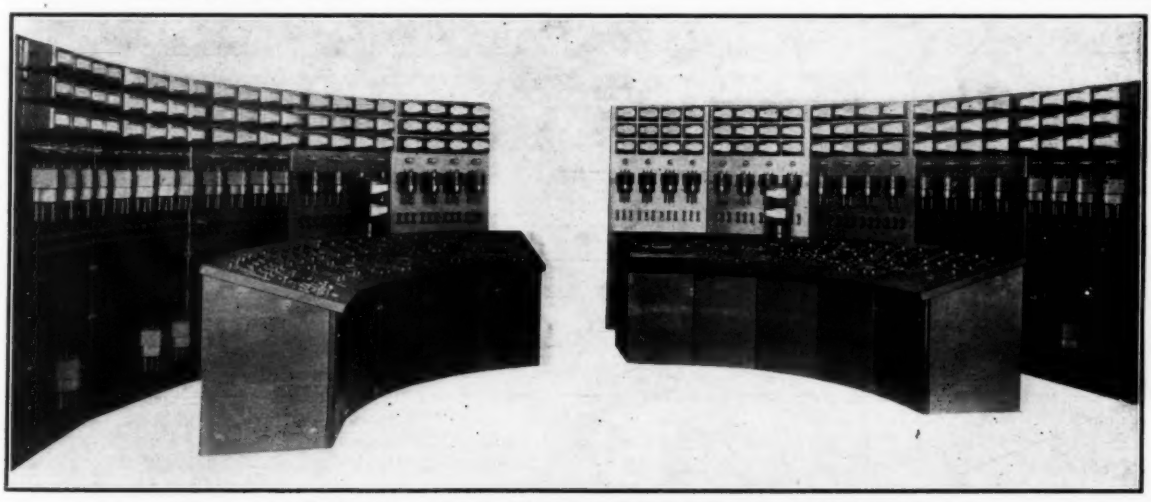


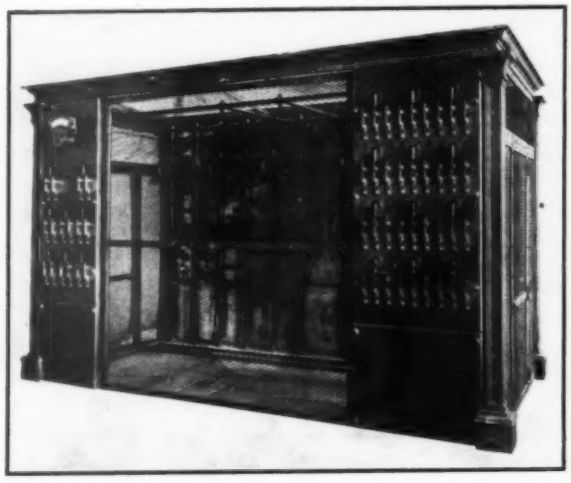
Fig. 17.—25 and 60-Cycle Boards of Milwaukee Electric Railway & Light Company.

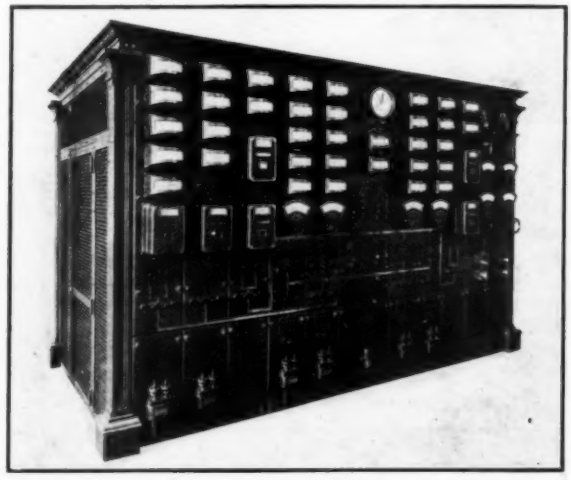
Fig. 17 shows a class C control board, and the system of connections for which it was designed is shown in Fig. 14.

Quite frequently in the very stations where class C control boards are applicable, the generator section of the board is separate from the feeder section, an operator being stationed at each section. In some cases the benchboard with its instrument board are built on the arc of a circle in order to make it more convenient for the operator. Fig. 17 is a notable example of such design.

As mentioned in the beginning of the article, control boards are sometimes of the vertical type, which are often more suitable than the bench type. Figs. 18 and 19 show one of these control boards. This board, for the Schenectady Power Company at Schaghticoke, N. Y., is built with an inclosure at the back similar to some of the class A benchboards.

No pedestal-type control boards are described in the foregoing, although some of this type have been built. There does not seem to be much reason for using this type, as no particular advantage from a construction or operating standpoint is gained therefrom over the types described.





Figs. 18 and 19.—Alternating-Current Board of Schenectady Power Company.

## Chicago Electric Club to Aid in Jovian Rejuvenation.

At the joint meeting of the Electric Club of Chicago with the Sons of Jove, held in Chicago, April 4, the club unanimously voted to lend financial support to Statesman J. H. Delany's efforts to hold a record-breaking rejuvenation in Chicago. By this action the club thought that it would be substantially endorsing the co-operative movement which the Jovian Order has recently undertaken.

**An aluminum wire, of equivalent conductivity, will have 48 per cent of the weight and 160 per cent of the strength of copper wire.**

## Committee Conference on Seattle Convention of the National Electric Light Association.

In view of the many questions necessarily connected with making arrangements at long range from the East for the convention of the National Electric Light Association at Seattle, next June, President Gilchrist decided to call a conference of chairmen and members of different committees directly engaged in the preparatory work. With this end in view, a meeting was held at Minneapolis, as a half-way point on Friday, April 5, at the Hotel Radisson, immediately following an Executive Committee meeting of the Commercial Section, which had brought together the day before a number of the prominent men serving on these Committees. The Seattle conference was presided over by President Gilchrist at the two long sessions held on Friday, and these meetings were followed by those of sub-committees, etc.

In attendance at the meeting were H. J. Gille, chairman of the Commercial Section, and C. H. Hodskinson, master of transportation and his associates, G. W. Elliott, F. H. Gale and G. A. Freeman; J. C. McQuiston, chairman of the Exhibition Committee, and Walter Neumuller, secretary, with J. H. Perry and S. E. Doane, members of the Committee; E. W. Lloyd, E. L. Callahan, J. Robert Crouse and Philip S. Dodd of the Commercial Section, and T. C. Martin, secretary of the National body. To meet these gentlemen W. J. Grambs came from the Pacific Coast on behalf of the hotel, entertainment, transportation and other committees of which he is chairman or an active member.

All the various subjects connected with the trip to Seattle and the arrangements and exercises there were taken up in detail. As practically all of the special trains will arrive on Sunday, June 9, and as there would be practically a clear day on Monday for registration, etc., it was decided to have the annual baseball match on Monday afternoon. This will be followed by the annual reception and opening of the exhibition at the Seattle Armory in the evening.

Mr. Hodskinson gave a full account of all the work of the Transportation Committee. He made an important announcement as to a special return trip from Seattle through the Yellowstone Park over the Northern Pacific Railroad, so as to accommodate those not on the special trains who may wish to take in that scenic feature. Mr. Hodskinson also gave details as to the entertainment features along the road, as at Los Angeles, San Francisco, Portland, etc. In connection with the invitation from the last-named city, it was decided to take the Tour De Luxe trains from Seattle to Portland on Friday, so as to enable the delegates to see as much as possible of the Rose Festival and the Electrical Parade, on Friday evening, leaving all of Saturday clear for the Portland trips and excursions before leaving for the Yellowstone Park in the evening.

In connection with the entertainment, Mr. Grambs outlined the provisions made for the entertainment of the ladies on Tuesday, Wednesday and Thursday, including an automobile excursion around the city and its suburbs on Tuesday; a sail on Wednesday on Puget Sound, and a visit to the Country Club and a golf tournament on Thursday.

Messrs. McQuiston and Neumuller made a full report as to the arrangements for the exhibition, and were

able to state that already more than half the space had been taken up, with a great deal of additional space already under negotiation.

Mr. Grambs made a full statement as to all the arrangements that were being carried out by himself as chairman of the Hotel Committee. He asked the members of the Committee present to use their power to secure as early registration as possible of all persons attending the convention.

With regard to the arrangement of the program, President Gilchrist stated that it was intended to dispose of the business in about eight sessions, some of which would be, of course, in parallel, this being needed to take care of the sixty-six items in the shape of papers, reports and special addresses. It was arranged during the conference that the Commercial Section would divide up its work this year into four sessions as it did last year. There will probably be three meetings on Tuesday, three on Wednesday and two on Thursday, and this will allow the exhibit to be thrown open to the general public on Thursday evening, an arrangement which will enable the association to comply with the general wish of the citizens to see this fine display of electrical apparatus—it being the first of the kind in Seattle. A meeting on Wednesday evening will adhere to the traditional program of the Association in being devoted to the presentation of the report of the Public Policy Committee, which again will deal largely with welfare work. This report will be followed by an illustrated lecture on the "Electrification of the Panama Canal."

It was stated by Secretary Martin that in order to deal satisfactorily with the convention work, he and the members of his staff needed for registration, issuance of badges, distribution of papers, etc., would proceed to the Coast at least two weeks in advance of the convention and establish the Association offices there. He will, in all probability, be accompanied by Mr. Neumuller and J. E. Murray to look after the work in connection with the exhibit and to insure the completion of all the arrangements by June 8.

G. W. Elliott stated that all the preparations had been made for the issuance of the *Convention Daily* along the lines of previous years, but with some new features; and that there would be four daily issues for Tuesday, Wednesday, Thursday and Friday. It was also announced that the Seattle Electric Company will devote its journal to a special pictorial issue illustrative of central-station and power-plant developments on the Coast, and to the scenery of Seattle.

## LETTERS TO THE EDITOR.

### Electric Cooking in Minneapolis.

*To the Editor:*

Seeing that, by your article on the Minnesota Electric Association (March 30, page 624), I was misunderstood in regard to the electric cooking proposition in Minneapolis, I desire to have this inserted as a correction.

The Minneapolis General Electric Company sold two of the early types of stoves, which were rated as of 4.5-kilowatt demand, but which so far exceeded this that it was necessary to change the five-kilowatt transformers serving the houses in which they were located.

I said the company used a sliding-scale rate, and expressed the opinion that these customers earned an average rate of five cents, in which I was mistaken. Upon later investigation of their records, I find their rate to have been a trifle over six cents, due to their excessive demand.

I expressed the opinion that the higher-grade stoves on the market today are remedying these defects, but in order to do so a stove must be a radical improvement over the early type sold by this company. This type is not now on the market. In addition central stations must give rates lower than regular residence-lighting rates, to secure the more ordinary class of homes.

V. S. Beck.

Minneapolis, Minn., April 4, 1912.

### Leads for Induction Motors.

*To the Editor:*

Referring to the editorial in your issue of March 23 in reference to the leads for induction motors, I would call your attention to a point which was evidently overlooked.

In referring to the motors connected to the centrifugal pumps driven by bar-rotor motors, I would consider that these machines started under practically no load, even though the pumps were primed, owing to the fact that the centrifugal pump requires power varying as the square of the speed, so that at one-fourth speed it would require little more than one-sixteenth full power. This would allow the motor to accelerate with no danger to the generator as it would not come to full load until at full speed, and the induction motor causes little line disturbance when it has accelerated to over half speed.

I agree that loaded motors that have to exert their full torque, or more, will take from two to seven times full-load amperes (not watts), in getting started, but this current is momentary only. This is covered by the local inspectors requiring that 25 per cent over capacity be given in copper. This is safe.

W. Montelius Price.

Seattle, Wash., March 27, 1912.

[In the editorial referred to it was not asserted, nor even intimated, that the load on the motor during acceleration was anything like the full-load horsepower of the machine. The exact statement was that the motor had "to accelerate under more or less load," with which statement the spirit of the above letter does not seem to disagree.

Relative to the use of leads only large enough to take care of a load but 25 per cent greater than that for which the motor is designed, it may be remarked that the approval of leads so small as this for induction motors appears to be very exceptional. Many inspection departments require conductors large enough to carry safely the current which the motor would take running on 50-per-cent overload. In some cases even larger leads than these are required.—Editor.]

## International Technical Committee's Report.

A report to the International Committee on Electric Units and Standards by the Technical Committee appointed to investigate the concrete standards of the international electrical units and to recommend a value for the Weston normal cell has been prepared under the supervision of S. W. Stratton. The Committee assembled at Washington under the presidency of Dr. Stratton, who is also treasurer of the International Committee.

The Committee unanimously elected as chairman E. B. Rosa, secretary of the International Committee. Other members are W. Jaeger, of the Physikalisch-Technische Reichsanstalt, Germany; F. Laporte, of the Laboratorie Central d'Electricite, France; F. E. Smith, of the National Physical Laboratory, England; and F. A. Wolff, of the United States Bureau of Standards. F. W. Grover was appointed secretary for the preparation of the minutes and records. The committee conducted experimental work at the Bureau of Standards for a period of two months, and carefully considered the results. The conclusions and recommendations are contained in the following resolutions:

(1) The committee decides to choose as to the value of the Weston normal cell the mean value of the cells presented by the delegates of the four laboratories. This mean was determined in the following way: there was first determined the mean value of the normal cells presented by each delegate, then the mean was taken of the four numbers thus found.

(2) The Committee decides to choose, for the present and until there are other mercury ohms prepared, as the value of the international ohm, to be recommended to all countries for general use, the mean of the values of the units realized at the Physikalisch-Technische Reichsanstalt and at the National Physical Laboratory. Although the international ohm as defined by the London Conference has not yet been strictly realized, the Committee believes that its value has been attained in two laboratories independently with a good degree of precision, and that future work is not likely to change it by more than 2 or 3 parts in 100,000.

(3) In view of the fact that the mean of the results with the silver voltameter obtained by this Committee will probably not be changed by more than a few parts in 100,000 when the specifications are finally completed, the Committee recommends the following value for the electromotive force of the Weston normal cell; 1.0183 international volts at 20 degrees centigrade.

On the subject of the standard cells, the Committee is of the opinion that new experiments are necessary before completing or changing the specifications of the London Conference.

On the subject of the ohm, the Committee expresses the hope that new international ohms, fulfilling all the specifications of the London Conference, may be realized soon in different laboratories.

On the subject of silver voltameter, the Committee is of the opinion that the specifications for the silver voltameter should not be completed until further experiments shall be made by the members of the Committee in their respective laboratories on subjects which are not considered settled at the present time, and that after these experiments the Committee shall complete the general specifications.

## Traction Company Buys Power From Municipal Plant.

The Henderson Traction Company, of Henderson, Ky., has completed arrangements with the city of Henderson whereby the power plant of the latter will supply current for the operation of the street-railway system. The rate charged will be one cent per kilowatt-hour. It is expected that the city will make a similar arrangement with the Evansville, Henderson & Owensboro Railway Company, which is beginning construction work in connection with an interurban line between the cities mentioned. It is likely that the municipal plant will be enlarged later on to take care of the additional production required.

## RELATION OF CENTRAL-STATION GENERATION TO RAILWAY ELECTRIFICATION.

### Monthly Meeting of the American Institute of Electrical Engineers.

The 270th meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York City, on April 5, with President Dunn in the chair. The meeting was under the auspices of the Electric Railway Committee, whose chairman, Frank J. Sprague, made some introductory remarks, after which Samuel Insull presented a paper entitled "The Relation of Central-Station Generation to Railway Electrification." Before presenting his paper Mr. Insull referred to the work which had been done by Messrs. Junkersfeld, Fowler, Gear and Bird, of the Commonwealth Edison Company, in preparing the material which he was about to present.

Mr. Insull's paper presented data showing the great advantages which might be gained from the generation of electric power in a single station for all purposes to which it is applied in any community, including especially the operation of electric railroads. The practicability of steam-railroad electrification, as well as the choice of systems, was excluded from the discussion. It was confined solely to the centralization of power development. The energy required to operate the terminal and suburban systems of all the trunk lines entering New York City is less than the energy used in isolated electric lighting plants in the same territory, and it presents no serious obstacles to the central station. The centralization of all power development in this country would be a great factor in the conservation of our coal as it would result in a saving of about 200,000,000 tons per year. Most small companies have been able to increase their load-factor from, say, 20 per cent to about 40 per cent, by extending their supply to all the public and private lighting, and to the pumping of water and all the other diversified power applications. The extension of the same principle to include all the electric railways would result in a still better load-factor, and every increase in diversity means decrease in the unit cost of power. The percentage of saving is comparatively small but the total amounts to a large sum. In Greater New York the saving in investment would amount to about $20,000,000, or fixed charges of about $2,000,000 per year, and the saving in the operating expenses would amount to another $1,000,000. A similar estimate based upon lighting, power and electrification for steam railroads of the entire country would, when capitalized on a five-per-cent basis, represent about $150,000,000. A large number of diagrams were shown giving the load curves for the central stations, electric railways, etc., in New York City, Boston and Chicago. Similar curves were given for steam-railroad electrification as actually carried out in New York and as estimated for Chicago terminals. The advantage in diversity-factor as the load was extended was prominently brought out. Other diagrams were given showing the daily load-factors in the three cities and the great improvement obtained in Chicago as compared with the other cities due to the electric-railway load of the central station there, combined with the great diversity in power load. In smaller cities the diversity in the load of the electrified steam railroads would be much greater on account of the lessened suburban traffic, which produces large peaks in the morning and evening. In order to take care of the maximum swing, the reserve capacity of the New York, New Haven & Hartford Railroad was about 74 per cent. The direct saving of a concentrated system of generation and primary distribution would be sufficient to provide funds for electrifying the steam railroads, as computed for the New York District. This policy of concentration which the author has been endeavoring to carry out in Chicago is one worthy of the thought and work of the greatest engineers and financiers in the country.

The discussion was opened by John W. Lieb, Jr., who called attention to the improved load-factors which had already been attained in this country compared to those in lighting and power stations abroad. This has resulted from the stimulation of all possible uses of electricity, even without entering the railway field. The addition of a railway load with a large morning peak would fit in very well with a lighting load. He considered the matter of the details of the system employed a very important one, especially as regards the present use of 15, 25 and 60 cycles on different forms of load.

Dugald C. Jackson spoke in appreciation of Mr. Insull's work and of the great importance of this question to electrical engineering.

W. S. Murray said that the railway men were in sympathy with Mr. Insull's ideas. The selection by the New Haven Road of 25 cycles put it in line for such evolution, since power for such work can be taken directly from the busbars of the generating station. The New Haven Road has authorized the extension of electrification from Stamford to New Haven on a single-phase basis, and it is expected to have this portion of the system ready within one year.

C. P. Steinmetz considered the paper the most important which had ever been presented to the Institute. He pointed out that although there was a limit to the diversity which could be reached by consolidation of large systems, there was no limit to the diversity-factor of the engineering staff, by which he meant that a large system could afford to employ engineering skill and talent which is prohibited to the small station.

L. B. Stillwell emphasized the limit to improvement of diversity after a system reaches a certain size, such as 100,000 kilowatts, and the limits to centralization set by continuity of service and diversity of voltage. He pointed out the great improvement in operating efficiency, which is being steadily attained. In the seven

years which had elapsed since the installation of some 5,000-kilowatt units by the Manhattain Railway Company the steam economy had been improved by four pounds per kilowatt-hour, as represented by the turbo-alternators most recently contracted for. Such figures, in the aggregate for Boston, New York and Chicago, represent a difference of 1,000,000 tons of coal per year.

C. A. Coffin spoke briefly in tribute to the work of the engineers.

B. F. Wood stated that the Pennsylvania Railroad had invested $4,000,000 in a power station in New York and $4,000,000 additional in other electrical appliances, excluding locomotives. They would have been glad to have purchased the necessary power at the rate existing in Chicago if it had been possible to do so.

Cary T. Hutchinson considered that the benefit of the centralization was realized mostly by the central station and was not sufficiently shared with the consumer in a low rate for power. The isolated plant cannot be expected to go into such a scheme unless it is offered a rate which is lower than its own cost of generation.

B. J. Arnold stated that the Commonwealth Edison station was one of the most economical plants for the production of electrical energy in the world. This is largely due to the possibility of a company of such magnitude discarding obsolete machinery and introducing the most economical methods. The street-railway company in a certain city had recently made a contract for its power under conditions such that the municipality had to approve the contract, and it has been shown to the satisfaction of the engineers of the city, the street-railway company and the central station that the power could be bought more cheaply than it could be generated. The price was 0.75 cent per kilowatt-hour. The other conditions at this place were: Coal at $1.80 per ton, taxes 1.5 per cent, interest 6 per cent, depreciation 5 per cent. Thermal efficiency of the plant was assumed to be 10.5 per cent, although figures as high as 12.5 per cent had been reached in some operating plants. The thermal efficiency does not increase much when the units increase in size beyond 10,000 kilowatts. The advantage in the larger units consists principally in decreased initial cost per kilowatt and decreased labor charges. Nine years ago the thermal efficiency of plants was not over eight per cent, and yet at that time railway companies found it cheaper to generate their own power.

F. J. Sprague called attention to the fact that the demand for power was continually increasing, both because of the increase in population and of the increase in uses for power. Engineers in planning for the future must seek every opportunity to increase the ratio of economical production of power to the wasteful uses of it. He called attention to the excessive requirements of water in New York City, and attributed it largely to the large number of non-condensing plants operating in that city, since the household use would account for only about one-third of the 125 gallons which were supplied per capita. The New York Central Railroad had not bought power for its electrification because it could not do so.

Mr. Insull closed the discussion by answering a few questions and the meeting then adjourned.

## What Water-Power Development Means to Southern Minnesota.

Speaking on this subejct before the convention of the Southern Minnesota Development Association at Mankato, April 2, E. L. Callahan, manager of the new-business department of H. M. Byllesby & Company, made some interesting comments on the effect that cheap power has on the commercial development of a community.

Sufficient obstacles of an engineering, financial and commercial character, he said, confront water-power development to make the task exceedingly difficult. Capital can be interested only upon the recommendation of experienced engineers and operators of the highest class after long and careful investigation.

The manufacturer who relies upon electric power supplied by a large central station is not worried or affected by coal strikes or coal famines from any cause. Steam stations easily keep several months reserve coal supply on hand and their rates remain the same, no matter how the price of coal rises. When the energy is developed by water power, properly reinforced by steam reserve stations, the continuity or service is made even more secure. Electric power in industries requires no trained attendants. The motors operate for any one having sufficient intelligence to throw a switch.

The rates for current generated by water power offer the best possible inducements to manufacturers for all classes. They practically assure their location in the vicinity of such power providing municipalities, commercial clubs and public spirited communities advertise these and other local advantages.

At present practically all water powers of a size sufficient to warrant development in Southern Minnesota have been developed. With the advent of additional industries the smaller water-power sites, coupled with existing power developments, may be converted into active power.

However, with the present 10,000 developed horsepower in Southern Minnesota, a net work of interurban railway lines in this section is assured. These lines will be utilized in transporting raw and finished products to and from the factories, and dairy and farm products to the cities. The interurban lines will get their power from the various long-distance power-transmission lines now in existence and contemplated.

In South Carolina, the Southern Power Company has accomplished wonders in stimulating the cotton-mill industry, and building up cities and towns. The development in cotton manufacturing has been remarkable, and is a big step toward manufacturing the cotton goods at home which have been heretofore manufactured abroad.

Niagara Falls power literally has made the manufacturing cities of Niagara Falls, N. Y., Hamilton, Ontario and others. Factories are served over a great area of New York and Canada.

The Cripple Creek and Goldfield gold mining districts in Colorado would not be worked at all today were it not for low-priced central-station power, a large part of which is supplied by a Byllesby company. Central-station power makes profitable the mining of low-grade ore. The same power company is now completing a 65-mile transmission line to serve the towns and farms down the rich, irrigated valley of the Arkansas River. Coal mines are operated also with electric power, and one motor-driven cement mill alone required 2,500 horsepower.

Near Dundas, Minn., the Byllesby Company has just connected six farms to the transmission line from Cannon Falls. The use of electricity on the farm for lighting and manifold power purposes is in its infancy in this country. In Germany and other European countries it has reached large proportions. It makes for more productive farming.

At Butte, Mont., water-power is carried 200 miles and used in operating the copper mines and mills to a larger proportionate extent industrially than any other place in the world.

A development of 100,000 horsepower is now being made on the New River in Virginia. Current will be transmitted 60 miles to Roanoke and delivered to the industries, practically every wheel of which turns by electric power; to the great Virginia iron mines, chemical works, smelters, etc. Another line will run through the valleys and towns where factories are located and being located, to the great Pocahontas coal fields, where there are 75,000 horsepower in steam awaiting to be supplanted with electric power, 30,000 horsepower of which is on this day under contract for substitution by electric power.

# New Electrical and Mechanical Appliances

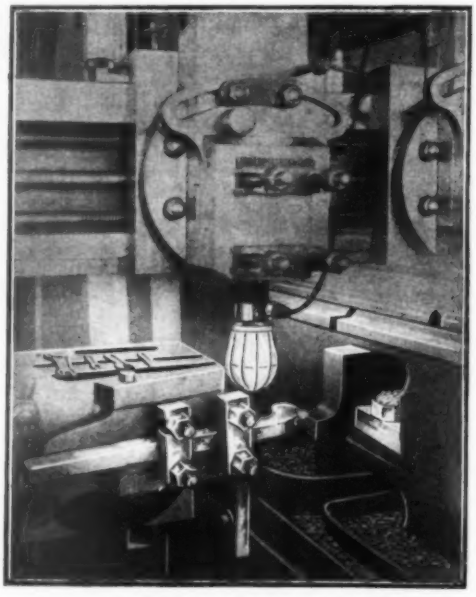
## The Sachs Magnalamp.

With the shortcomings of the present arrangements and devices in mind and the object of providing a lighting device by means of which the light can be directed on the tool or the work from the top, side or any other point, the change of position being instantly accomplished, the Sachs Magnalamp has been developed. It is a portable electric lamp using the ordinary incandescent bulb but incan be instantly changed and heat, cold, jar or vibration does not affect it grip.

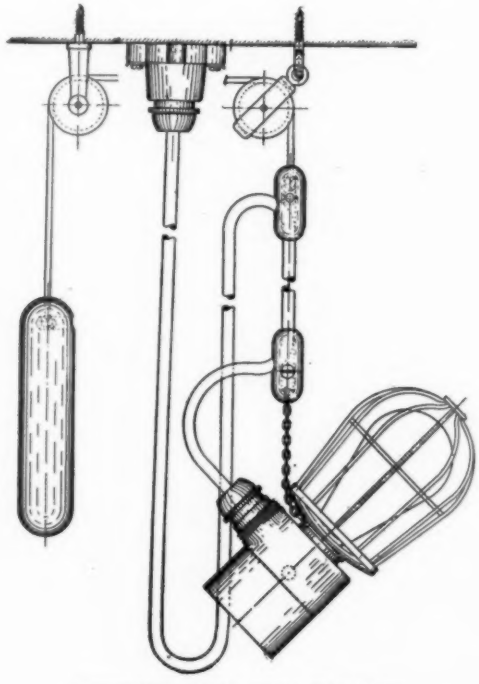
The complete Magnalamp, with its efficient electromagnet surmounted by the lamp and connection receptacles and switch mechanism, forms a cylinder measuring less than 3 inches in height and only 2.5 inches in diameter and weighing less than two pounds. The incandescent bulb, protected by an exceedingly strong electrically welded guard, extends either longitudinally from the top end of the cylinder or radially from the side, and its position can be changed from one to the other with great rapidity. A reflector detachably fitted to the inside of the guard is also provided. Current is supplied by a small highly insulated and mechanically strong flexible cable ending in a connecting plug which can be screwed into either receptacle, the lamp being placed in the other. The same current supplies the lamp and magnet which latter consumes a scarcely appreciable amount of electrical energy.

The current is controlled by a quick-acting switch operated by means of a knurled disk forming the central pole piece of the magnet. Gripping this pole piece with the thumb and forefinger on its outer or knurled edge and turning it clockwise turns the switch completely on or off with each snap. This switch cannot be operated when the magnet is in use, an obvious advantage. Grasping the lamp in hand, after the current has been turned on and the lamp lighted, and pressing the little push-button, which extends radially from the side of the switch and receptacle casing above the magnet, de-energizes the magnet so that the lamp may be removed or changed in position, while releasing this button instantly brings the magnet into service again. After the light has once been turned on by the switch it remains on irrespective of whether the magnet is cut out and consequently it is never necessary to manipulate the lamp without light.

For its proper operation the Magnalamp requires direct current and is furnished in two standard voltages,



Use of Sachs Magnalamp on Machine.



Counterbalance for Sachs Magnalamp.

herently possessing magnetic adhering power so that when placed on any mass of iron or steel, smooth or rough, even or uneven, painted or unpainted, it sticks and holds itself in the position placed with a pull of scores of pounds. It can be placed with equal facility on machine tools, girders, bars, castings, automobile frames, engines, locomotives, rails, vault frames, safes, pipes or any structure that is entirely or partly composed of iron or steel. It stays wherever put, as if it were cemented to or formed a part of the surface to which it is held by its own adhering power. It hangs vertically from a surface above or extends sidewise just as rigidly as to a surface on top of which it may be placed. Its position

110 and 220 volts. The ordinary carbon-filament 16-candlepower incandescent lamps of either can be used. If used with smaller lamps the magnetic grip is less, due to the smaller current taken. Lamps of larger candlepower may be used, in which case the magnetic grip is increased.

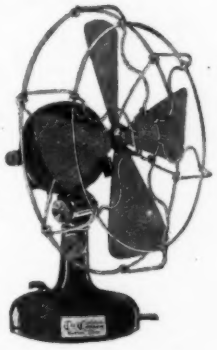
When used as a portable self-adhering lamp, connection may be made by means of the plug at the free end of the flexible cable with any socket. Its installation, however, as a permanent lighting fixture in conjunction with the Magnalamp counterbalance device results in additional advantages and facilitates its manipulation. Installed in this manner the Magnalamp when not attached magnetically, serves as an ordinary drop light automatically placed at any suspension height and is instantly reached when wanted as a self-adhering lamp to be placed in any desired position on the machine tool or the work which it illuminates.

The counterbalance outfit consists of two insulating clamps; one is detachably connected to the Magnalamp by a short chain and clamped to the flexible cable close to the plug inserted in the lamp receptacle and the other at a suitable distance beyond is attached to a strong cord passing over one or more ceiling ulleys with a balancing weight at the other end. All strain between the Magnalamp and weight is taken by the flexible lamp-connecting chain, the conducting cable between the clamps and the cord, thus relieving any pull on the plugs or sockets.

Combined with the counterbalance fitting the facility with which the Magnalamp can be manipulated is indeed surprising. The economic advantages resulting from this new self-adhering lighting device have been well demonstrated in numerous large manufacturing plants in which it is being used with and without the counterbalance. The Sachs Laboratories, Incorporated, of Hartford, Conn., manufactures the Magnalamp and counterbalance outfits.

## Carleton Electric Fans.

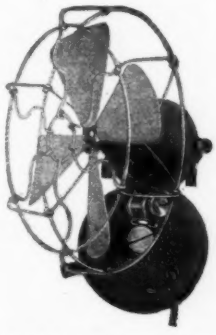
The two accompanying illustrations give a fair idea of the appearance of the new Carleton electric fans manufactured by the Carleton Company, 170 Summer Street, Boston, Mass. These fans are made in six, eight and eight-and-five-eighth-inch sizes. They are wound for either alternating or direct-current service. All of these fans have unique universal adjustments, by means of which the fan may be swiveled and turned in any desired direction, even when used in the bracket position. The finish of the motor and base are of the conventional black enamel of excellent quality. The bright parts, however, which include bearings, oil cups, guards, blades, hinged joints and adjustment screws, are all heavily nickeled on brass; this gives them a very attractive appearance. Standard motors are wound for 110-volt circuits. The commutator is exceptionally well made, having a large number of segments and being constructed of the



Carleton Desk Fan.

built-up type. The two larger sizes of fans have a switch and three-speed controller mounted in the base. All these fans are sparkless, economical of current consumption and so nearly noiseless that they may be used in bedrooms or telephone booths without any annoying disturbances.

The company also makes a line of battery fans which have been carefully designed for high economy. This enables them to be used with any



Carleton Bracket Fan.

kind of wet or dry primary battery or with storage batteries. These battery fans resemble the 110-volt fans in external appearance and in adjustments. They are made in the six and eight-inch sizes, and wound for 6, 12 and 20 volts. Such fans are very useful in many places where regular lighting service is not available, as, for instance, in boat cabins, summer cottages, etc. The battery fans, as well as the standard fans, made by this company are fully guaranteed.

## Southern Pacific Purchases 600-1,200-Volt Locomotives and Cars.

Six direct-current 60-ton Baldwin-Westinghouse electric locomotives and 20 Westinghouse car equipments with H L control have been purchased by the Southern Pacific Railroad Company for operation on the Southern Pacific and the Pacific Electric Company properties.

Both the car and locomotive equipments are arranged for operation on either 600 or 1,200 volts. Most of the lines now operate at 600 volts but there are portions served with 1,200 volts and the double-voltage equipment was selected so that it might be used on any portion of the system and on such 600 or 1,200-volt extensions as may be built in the future.

The 60-ton locomotives, each of which will have an aggregate motor capacity of 1,000 horsepower, will be the largest 1,200-volt, direct-current locomotives ever built. They will have quadruple equipments of commutating-pole motors that are rated at 225 horsepower at 600 volts with natural ventilation and 250 horsepower at 600 volts with forced ventilation. This motor has all the characteristic features of Westinghouse railway-motor construction, such as spider armature construction, rugged brush-holders and oil and waste lubrication.

Because of the large capacity of the motors the duty on the control equipments will be very severe. Westinghouse H L control, which has already demonstrated its fitness for controlling motors of great capacity on the Pennsylvania locomotives, will be used.

The mechanical parts for the locomotives will be furnished by the Baldwin Locomotive Works. The cabs and frames will be entirely of steel.

A Westinghouse dynamotor-compressor will be used on the cars and locomotives for operating the air compressor and for furnishing 600-volt current for both control and light circuits when the equipment is on the 1,200-volt sections of the line.

The 20 passenger cars will be furnished by the Pullman Palace Car Company. Each car will have quadruple equipments of Westinghouse commutating-pole motors each rated at 50 horsepower.

## Holophane Company Absorbed by General Electric.

The General Electric Company has recently completed negotiations for taking over the entire Holophane organization consisting of both sales and manufacturing departments. The Fostoria Glass Specialty Company will be united with the Holophane organization, probably in the form of a new company. The sales and engineering parts of the business will be directly under the charge of V. R. Lansingh, while the manufacturing will be under the charge of E. O. Cross.

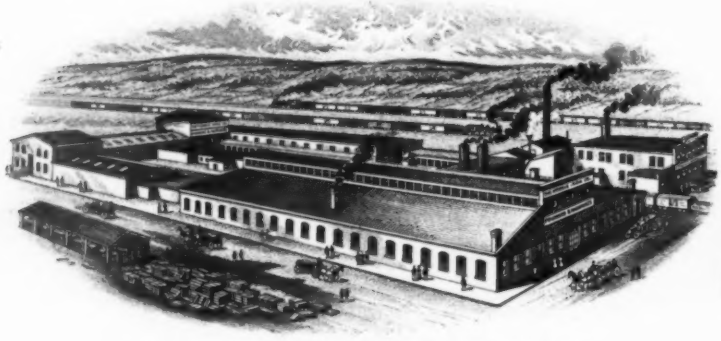
## New Plant of the Morris Iron Company Completed.

The large new plant of the Morris Iron Company, which has been in course of construction at Frederick, Md., since January of last year, has just been completed. A good idea of its extent is obtained from the illustration herewith. Among the buildings in this plant are the following: The pattern-storage building is 60 by 100 feet and two stories high. The foundry is 125 by 476 feet and is equipped with an electric traveling crane, three large core ovens, two cupolas and a large assortment of molding machines, sand-screening machines, sand-blasting apparatus and air-chipping hammers. The blacksmith shop, 60 by 80 feet, is equipped with an array of modern forges, tools and pipe-bending machines. The machine shop, 290 by 60 feet, contains a large number of strictly modern motor-driven tools, special boring mills and lathes for turning poles; both air and electric drills and chipping hammers are provided. The power house contains two direct-connected generating sets, developing 250-volt direct current; also a 350-cubic-foot air compressor for supplying hoists, sand blasting and other pneumatic tools. The office building is a two-story structure 40 by 100 feet. There is a warehouse 60 by 175 feet, with a 12-foot loading platform along its entire length. The oil and paint warehouse measures 30 by 80 feet. The iron and pipe sheds cover 36 by 72 feet, permitting the carrying of a large stock of raw materials on hand. The coke bins have a capacity of 20 carloads.

Railway connections are conveniently arranged with the Pennsylvania, Baltimore & Ohio, and the Frederick Railroads. The tracks and switches are so arranged that all freight can be handled without hauling. A 100-ton railway-track scale is provided. Within and connecting all the buildings is an industrial narrow-gauge track. In the power equipment are some 26 motors ranging from 3 to 15 horsepower. The lighting is by means of flaming arc lamps in the foundry and by means of tungsten lamps in the other departments. In the drafting room is an electric blue-printing machine for facilitating reproductions of drawings.

When work was begun on the new plant it was anticipated that about 150 regular employees would be required. The growth of the business of the company, however, has been such that the plant has been opened with over 200 employees, and the prospects are that at least 50 to 100 more will be engaged before the end of the summer. Since April 1, 1911, over 2,500 ornamental street lighting poles have been shipped or ordered from the company. These and its other products have gone to over 300 cities in the United States, to Japan, Australia, the Philippines and almost every country in both North and South America. The new plant places the company in a position to handle properly and promptly orders for its extensive line of ornamental poles, lighting and railroad brackets, and for general and special foundry work. The company reports that the outlook for business during the coming year in ornamental lighting poles indicates that the business of 1911 will be largely exceeded.

The erection of the plant has been under the immediate supervision of Elmer P. Morris, vice-president of the company, who has made his home at Frederick until the construction was completed. Mr. Morris will now devote his personal attention to the sales department, whose headquarters are at 90 West Street, New York City.



New Plant of Morris Iron Works, Frederick, Md.

## Electroplating on Glass.

A new method of electroplating upon glass, porcelain and the like, which is said to give very good results, has been described in the *Scientific American*. It is the invention of an Italian engineer, Q. Marino, who obtains an adherent deposit of different metals on such surfaces. In the first place, the surface of the glass is roughened by a sand blast, then it is covered with a paste made of hydrofluoric acid and a chloride or other salt of the metal which is to be deposited on the surface. The object is finally put in an appropriate electroplating bath in order to receive a coating of the metal desired.

## New Pass & Seymour Fixture Combination.

In the accompanying illustration is shown a neat fixture manufactured by Pass & Seymour, Incorporated, of Solvay, N. Y. It consists of receptacle No. 44, which may be used as a wall receptacle for flat surfaces, or as an outlet-box receptacle for standard three-inch or four-inch boxes.

Pass & Seymour Fixture.

Mounted thereon is the Shurlock attachment, which has met a very decided demand for a positive lamp-socket lock. As can be seen, it is very unobtrusive in appearance, yet it protects absolutely the lamp, shade and shade-holder against theft. An effective shade-holder, a high-efficiency lamp and a well designed reflector complete the outfit.

## A 7,500-Kilowatt Commutating-Pole Rotary Converter.

Real estate in New York and other large cities is very expensive, so it is imperative that the Metropolitan public-service companies use every square foot of generating and substation floor area most effectively. In rotary-converter substations a very large portion of the requisite floor space is occupied by the converters. Considerable study has been given by electrical machine designers to the matter of concentrating maximum rotary-converter capacity in minimum floor space so as to meet this condition to the satisfaction of the operating companies. In

some instances it has been found necessary in the large cities to increase materially (sometimes to double) rotary-converter substation capacities without increasing the station floor areas.

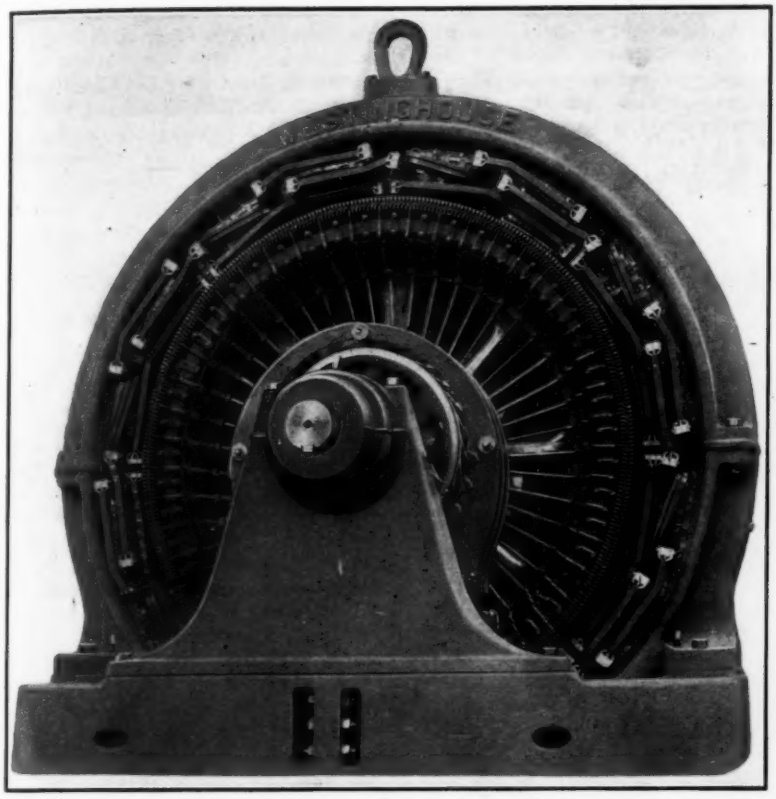


Fig. 1.—7,500-Kilowatt Rotary Converter for 600-Volt Subway Train Service.

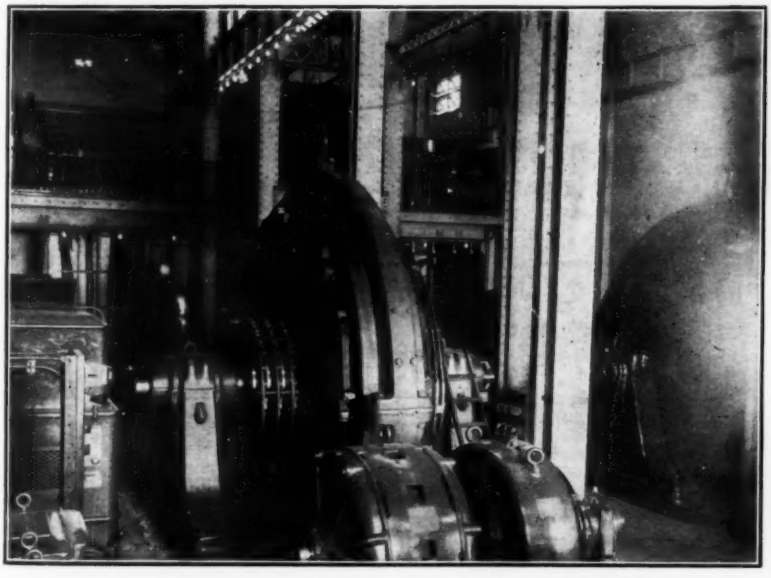


Fig. 2.—Same Converter Installed in Interborough Substation.

When some two years ago two 25-cycle, six-phase, 600-volt, 3,000-kilowatt rotary converters were built by the Westinghouse Electric & Manufacturing Company for the Interborough Rapid Transit Company and installed in the space formerly occupied by two 1,500-kilowatt converters of similar characteristics, it was believed that practically the maximum point of concentration had been reached. The output of the station in which they were installed was doubled without increasing floor area. During the past two years the Interborough Company has installed eight of these machines.

Now comes the announcement that a 7,500-kilowatt, 600-volt, six-phase, 25-cycle, commutating-pole rotary converter has been installed and is operating perfectly in the Ninety-sixth Street substation of the Interborough Rapid Transit Company. Fig. 1 shows the machine just after completion in the Westinghouse shops. Fig. 2 shows the machine as installed. A most remarkable feature is that the present 7,500-kilowatt machine occupies but a trifle more floor space than was occupied by each of the old 1,500-kilowatt machines which were standard with the Interborough Company a few years ago. This is shown by a comparison of the new machine (in the middle of Fig. 2) with one of the older machines at the right.

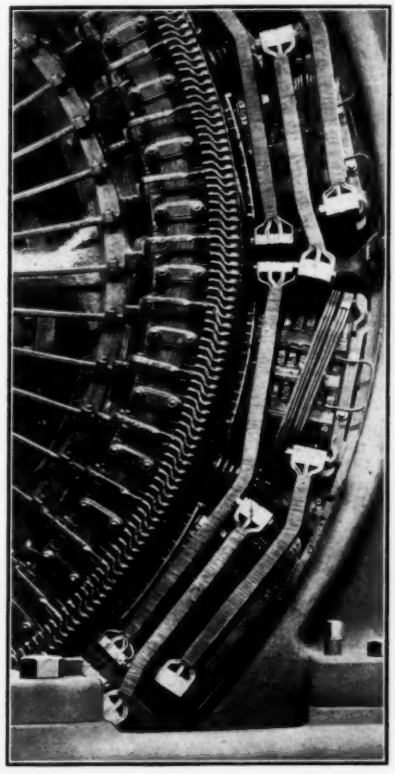


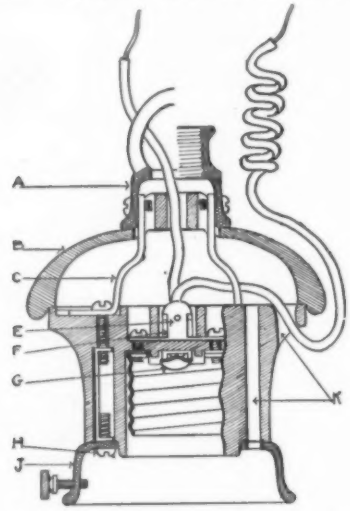
Fig. 3.—Enlarged View of Armature and Field Windings.

Although guaranteed to take care of load swings, such as are inherent to heavy subway service, up to 7,500 kilowatts, the new machine has successfully handled swings one-third greater than its rating, or up to 10,000 kilowatts.

The new rotary is a six-phase, 25-cycle machine and operates at 600 volts on the direct-current side. The equalizer connections and the method of connecting the main field and the commutating-field coils are shown in Fig. 1. An enlarged view of a portion of the same converter is given in Fig. 3, in which the commutating poles and windings and their relation to the main poles is plainly reproduced.

## A Weatherproof Industrial Lighting Unit of Unique Design.

The development laboratories of the Tungstolier Company recently completed a unique weatherproof unit for industrial and commercial lighting service, which will be placed upon the market within a few weeks. In this design two things were sought: a unit that should be absolutely weatherproof and of the sturdy construction demanded in an exposed fixture, and interchangeability which would permit the central station or contractor to meet any reasonable requirement without the necessity either of carrying a large stock or being compelled to wait upon the factory shipment. This latter feature is characteristic of practically all of the Tungstolier Company's product, convenience, economy and service to the middleman being considered of equal importance with the requirements of the final user. The accompanying illustrations of this new Tungstolier unit show its construction and suggest its wide field of usefulness.




Section Through Weatherproof Unit.

The "foundation" of the unit is a porcelain housing consisting of body and crown *B* which are separate, and within which there is plenty of working space for the easy handling or changing of connections. Above the crown is fastened a suspension cap *A* which may be either for chain or rod suspension. To the suspension cap are fastened the supporting straps *C* which pass through the body to the shade-holder *J*, thus relieving the porcelain of all weight and strain. Four sizes of cast-metal holders are available (3.25, 4, 5 and 6 inches) and these are interchangeable, being fastened by a screw *H* to the supporting straps. Ample ventilation is afforded by the holes *K*, of which the upper ones are also used to pass the feed wires when weatherproof wiring is employed.

The Tungstolier weatherproof unit is available in a variety of practical styles for different classes of service, such as warehouses, foundries, machine shops, store rooms, freight platforms, yards, store fronts, etc. The desirable feature from the standpoint of the trade is that the units can be adapted to different service conditions by the use of standard material, thus decreasing the amount of stock necessary to meet a normal diversity of demand. Chain-suspension and pipe-suspension ceiling types and bracket-support forms are all shown in the new Tungstolier bulletin No. 130, about to be issued on these new units.

Pendent and Bracket Units.

## The De Laval Steam Scale and Diagram.

The Mollier diagram is now generally well known to engineers as the most convenient means of determining, with all the accuracy reasonably required, the heat available from the expansion of steam from a given initial condition to a given final condition, and also for determining by comparison therewith the efficiency ratio of an engine or turbine of known steam consumption, or the quality of the steam at the end of expansion in a heat motor of which the steam consumption is known.

As the Mollier diagram is ordinarily arranged, however, its use is rendered difficult and its accuracy impaired by the fact that the total heat of the steam in the initial condition must be read off from the scale and the operation repeated for the final condition, after which the figures are subtracted one from the other and multiplied by 778 to give the available foot-pounds, while to obtain other quantities involves several more tedious arithmetical operations.

All these difficulties are removed at one stroke by the use of the steam scale devised and published by the DeLaval Steam Turbine Company, Trenton, N. J. This steam scale is a graduated measuring rule, bearing four different scales. The first having uniform graduations may be applied to the chart to measure directly the British thermal units available between given initial and final conditions of the steam. A second edge of the rule bears a scale showing the resulting velocity of the steam when expanded through a nozzle in feet per second, which may also, therefore, be read off at once without computation. A third edge shows the duty in millions of foot-pounds per thousand pounds of steam developed by a perfect engine working between the limits assumed, while the fourth edge gives the steam consumption in pounds per horsepower-hour. Conversely, if the steam consumption of an actual engine be known, the last named scale enables the user to find the resulting quality of the steam at once from the diagram, without further measurement or computation. With this chart and scale in his possession, the engineer possesses the equivalent of complete steam and entropy tables, also tables for converting British thermal units per pound of steam to jet velocity, steam consumption and duty without computation. The limits of error appear to be in general less than one per cent and the accuracy is greater than this for some of the operations.

On the back of the chart are printed concise directions for using the scale, with an illustrative example. Copies of the scale and chart can be obtained from the company by those interested.

## Private Long-Distance System.

A private long-distance telephone system is one of the novel operating features of one of the large Michigan automobile manufacturing companies. This company, with its general office in Detroit, has plants at Flint, Lansing, Saginaw, Jackson, Pontiac and Owosso, and all are in direct private-wire communication with each other and the general office. A total of 370 miles of wire was used in connecting the plants with the office in Detroit.

# Current Electrical News

## LIGHTING AND POWER.

*(Special Correspondence.)*

DUBUQUE, IOWA. — Boulevard lights will be installed. C.

LOCKPORT, LA.—A. V. Smith is promoting an electric light company for this place.

PORT ARKANSAS, TEX.—Jones & Cotter will build an electric light and power plant here.

CHARLES CITY, IOWA.—A movement is on foot to install electroliers on Main Street. C.

WELLSVILLE, O.—This city is planning the erection of a municipal electric lighting plant.

WARREN, MINN.—The council is considering the installation of an electric light and power plant. C.

KNOXVILLE, IOWA.—The Knoxville Electric Light Company is considering building to Pleasantville.

LONG PRAIRIE, MINN.—There is an agitation to install a direct-connected engine and generator for the village light plant. C.

ROGERS, ARK.—The Rogers Light and Water Company is about to improve and extend its electric service.

CAMP HILL, PA.—The Borough of Camp Hill is contemplating the installation of a municipal lighting and water plant.

WASHBURN, N. D.—The Commercial Club has under consideration the matter of building and maintaining an electric light plant here. C.

DULUTH, MINN.—The City Council has under consideration the erection of a municipal electric lighting plant in this city.

MARLIN, TEX.—The City Council has granted a franchise to Waco parties for the establishment of a power system in Marlin.

CAMDEN, N. J.—The City Council has passed an ordinance providing for a $300,000 bond issue to build a municipal lighting plant.

OAKLAND, IOWA.—The Oakland Electric Company has been organized by J. W. Tubbs and others to install an electric light plant.

NORFOLK, VA.—The Common Council and the Light Committee are planning for a "White Way" of tungsten lamps in Norfolk.

CORYDON, KY.—The city is considering the construction of an electric light plant. For further information address the Mayor.

LOUISVILLE, KY.—The Louisville Lighting Company is making arrangements to extend its line to Jeffersontown, a suburb of the city.

JACKSON, MINN.—There is an agitation for equipping the village electric light plant to operate a day current. The cost is estimated as $3,200. C.

FORT PIERCE, FLA.—D. D. & C. M. Rogers, engineers, Fort Pierce, have charge of the construction of the city's electric light plant.

MONTEVIDEO, MINN.—The question of lighting First Avenue, was brought before the Commercial Club. The club is advocating cluster lights. C.

PLAINVILLE, TEX.—The Malone Light & Ice Company will install a new engine and other machinery in its electric light and power plant here.

MOUNT CORY, O.—This village has decided to issue bonds in the sum of $12,000 for the purpose of establishing a municipal electric light plant.

SILVER CITY, N. M.—The Silver City Electric Power Company will install a large ice factory here in connection with its electric light and power plant. D.

LUVERNE, MINN.—The Council is considering the establishing of a day service. This will necessitate the purchase of about $5,000 worth of new machinery. C.

WINOOSKI, VT.—The Burlington Light & Power Company will take out the present street lamps throughout the village and replace them with the magnetite type.

FLORESVILLE, TEX.—Floresville Ice & Power Company has been incorporated with a capital stock of $10,500 by W. G. Rolaff, Richard Wolfsky and Yale Hicks.

FOLEY, MINN.—The Foley Village Council has granted a franchise to Harmon Becker, giving him the necessary authority to build an electric light plant.

BUTLER, MO.—The city contemplates installing additional generating equipment in the electric light and power plant. Charles W. Miller is the engineer in charge.

PAWNEE ROCK, KANS.—Pawnee Rock Light, Power & Ice Company has been incorporated with a capital stock of $5,000 by A. M. Peters, B. H. Bowman and J. R. French.

FRANDREAU, S. D.—The Ladd Electric Company has been granted a franchise for an electric light and power plant in this place. Work is expected to begin on it at once.

DENTON, TEX.—The capacity of the municipal light and power plant is to be more than treoled by the installation of new equipment. The system of lighting will also be improved.

MARLIN, TEX.—The Marlin Ice & Electric Company has organized here with a capital stock of $130,000. The incorporators are I. J. Nathan, N. D. Naman and George H. Carter.

LYLE, WASH.—Plans are under way for the construction of an electric light plant here, which it is understood will be financed by Le Roy Park, D. E. Keasey and their associates of Portland.

HUSUM, WASH.—The Northwestern Electric Company, it is alleged, will construct a big power plant at an estimated cost of $1,000,000, on a site three miles below here on the White Salmon River.

DECATUR, TEX.—The municipal electric light and power plant here, which was recently destroyed by fire, will be replaced by a new plant at a cost of about $16,000. Two dynamos will be installed. D.

COON RAPIDS, IOWA.—S. D. Henry has been granted a franchise for the operation of his electric light plant, to which he is planning to add new machinery. It is also planned to extend the line to Dedham. C.

PITTSBURGH, PA.—The Mount Lebanon Electric Company has been organized by W. W. Murray and Charles A. Lambie to supply light, heat and power to Lebanon township. A state charter will be issued to the company.

BOISE, IDAHO.—With a capitalization of $900,000 articles of incorporation have been filled for the Snake River Power Company, whose object is to furnish light and power to this city at low rates. The incorporators are all Boise men.

OAKFIELD, WIS.—The Oakfield Light & Power Company has been organized with a capital stock of $6,000, and a committee is investigating different plants in villages of the size of Oakfield with a view to erecting a plant at this place.

BIRMINGHAM, ALA.—The Tidewater Power Company has been incorporated with a capital stock of $2,000. J. M. Dewberry is president and R. D. Johnston, Jr., secretary of the company, which will have headquarters in this city.

ALBEMARLE, N. C. — Charles Armstrong represents Boston interests who are organizing to develop power on the Yadlin River, a few miles below the Whiteney plant. Mr. Armstrong says that $3,000,000 will be needed for the project.

PROVIDENCE, R. I.—Arthur B. Lisle, general manager of the Narragansett Electric Lighting Company, has announced that the increase in capital stock of the company from $7,000,000 to $10,000,000 is for the purpose of making some large improvements.

COLUMBUS GROVE, O.—A new $10,000 interurban station building, with power house combined, is to be erected in this village this season. The portable power house which has been located here for the past three years will be taken on the Lima-Defiance division. Ira S. Putnam has been appointed operator. H.

GLENVILLE, N. Y. — Tri-Town Electric Company has been incorpo-

rated with a capital stock of $10,000 to manufacture electricity for light and power purposes for certain towns in Schenectady and Saratoga Counties. The incorporators are Michael J. Hughes and Samuel M. Strong, of Rexford; and A. T. C. Wemple, Schenectady.

YOAKUM, TEX.—J. W. Greer and associates have been granted a 50-year franchise by the City Council to construct and operate an electric street railway upon certain streets of the town; and to install a gas manufacturing plant and distributing system. The plans of Mr. Greer and associates involve the construction of a large hydro-electric plant on the Guadalupe River, about twelve miles from here. D.

MALVERN, ARK.—Hot Springs County Light & Water Company has been incorporated with a capital stock of $25,000. The incorporators and officers are: John T. Gray, president, and T. B. Lee, secretary and treasurer. The purpose of the company is to erect and maintain an electric lighting plant for generating electricity for lighting and power to be distributed to towns in Hot Springs County.

GALLATIN, TENN.—Articles of incorporation have been filed by the Cumberland Valley & Interstate Electric Railway Company, the capitalization of which is $50,000. The incorporators are Harris Brown, W. Y. Allen, W. G. Schamberger, Judge William Hall and William B. Brown. The company will build a line to Danville or Stanford, Ky., probably connecting with the lines of the Central Kentucky Traction Company at Lexington. The probable route will be by way of Westmoreland, Hartsville and Lafayette, Tenn.

FRESNO, CAL.—The Pacific Light & Power Company has begun its plan of extension and in the furtherance of this scheme has closed a deal for five local plants, at San Miguel, Paso Robles, San Luis Obispo, Arroyo Grande and Santa Maria. The plans of the company in full are the building of the Big Creek Power dam, the construction of a railroad to be used in connection with it in Kern county, the stringing of power lines all over Southern California to give light and power to electric railroads and cities, and eventually connecting the Coast power plants with those of San Joaquin Valley.

RICHMOND, KY.—Plans for the erection of a large power plant on Dix River have been crystallized through the organization of the Dix River Power Company, which will have the following officers: L. B. Herrington, Richmond, Ky., president; Harvey Chenault, Richmond, secretary; Bethel B. Veech, Louisville, treasurer. The company will build a plant with a capacity of 24,000 horsepower on Dix River near its confluence with the Kentucky. A concrete dam 200 feet high will be built. Besides being constructed to immediately surrounding towns including Stanford, Lancaster, Nicholasville and Danville, transmission lines will be extended to Lexington, Louisville and Cincinnati, according to the announcement for those interested. As surveys have been under way for some time, it is expected that work may begin in the near future.

## TELEPHONE AND TELEGRAPH.

*(Special Correspondence.)*

DOGDEN, N. D.—A franchise has been granted to the Dogden Telephone Company. C.

DENNIS, KANS.—The Dennis Telephone Company has been incorporated with a capital stock of $6,000.

CHENEY, NEB.—The Cheney Telephone Company has been incorporated with a capital stock of $2,000.

LEXINGTON, S. C.—The Citizens Telephone Company will shortly build two new lines from the court house.

GLENCOE, MINN.—The Glencoe Telephone Company will extend its lines into Silver Lake and surrounding territory. C.

OOLOGAH, OKLA.—The Oologah Telephone Company has been incorporated with a capital stock of $1,500.

BEXAR, TENN.—The Bexar Telephone Company has been organized to operate a telephone line from Bexar to Ripley.

LOWVILE, N. Y.—The Black River Telephone Company, of this place, will install a switchboard in the village of Adams.

AITKIN, MINN.—P. W. Seedburg has the contract to construct a private telephone line for A. W. Smith to Wealthwood. C.

BARTLETT, KANS.—The Hackberry Mutual Telephone Company has been incorporated in this place with a capital of $2,000.

FARRIS, MINN.—The Tri-County Co-operative Telephone Company has been organized and 10 miles of lines will be constructed. C.

GAYVILLE, S. D.—The Gayville Telephone Company has been incorporated with a capital of $5,000, by Peter Lund and others. C.

WARDEN, WASH.—It has been decided to grant a franchise to the Hicksville Wheeler Telephone Company for the extension of its line into this city.

HOT SPRINGS, ARK.—Arkansas Telephone & Telegraph Company has been incorporated with a capital of $10,000. The incorporators are John T. Gray, W. H. Connell, J. L. Graham.

VERNDALE, MINN.—A rural telephone company has been incorporated to be known as the High Prairie Telephone Company. John Holzmer is secretary. C.

LADYSMITH, WIS.—The Chippewa Valley Telephone Company is planning to practically rebuild the Ladysmith System, at an estimated cost of $8,000.

MISSOULA, MONT.—The Independent Telephone Company will construct an extension into the Orchard Home district. Other extensions are also contemplated. C.

PITTSBURGH, PA.—It is announced that the Central District & Printing Telegraph Company has appropriated about $81,000 for improvements to the telephone plant in Pittsburgh.

KAPPA, ILL.—Kappa Telephone Company has been incorporated with a capital stock of $500 to operate a telephone exchange. The incorporators are J. B. Drake, F. E. Dixon and Jacob Betzger.

THAYER, IOWA.—The Eastern Union County Telephone Company has been incorporated with a capital stock of $650. The incorporators include A. R. Stoner, M. Earley and Daniel Swindler.

GRATIOT, WIS.—LaFayette County Telephone Company has been incorporated with a capital stock of $50,000. The incorporators are H. W. Burmeister, E. J. Hilary and F. M. McEmery.

JAVA CENTER, N. Y.—Java Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are E. J. Conroy, Lizzie M. Conroy and John R. Griffith, all of Java Center.

STRATHCONA, MINN. — Transsiberian Rural Telephone Company has been incorporated with a capital stock of $1,500. The incorporators are C. H. Nordby, John Stramer, Herman Spjut, all of Strathcona.

JOSEPH, UTAH.—Joseph Telephone Company has been incorporated with a capital stock of $4,000. Jesse Willes is president; James A. Ross, vice-president; John A. Parker, secretary and treasurer.

ASHLAND, O.—Ashland Telephone Company has been incorporated with a capital stock of $125,000. The incorporators are W. B. Seaton, Charles F. Weaver, Charles Russell, John Russell and Harold Means.

STEPHEN, MINN.—The Stephen Red River Telephone Company has been incorporated and will construct a line west of the city. The Northwestern Telephone Exchange will improve the local system. C.

ANDALE, KANS.—John Bender, of Haven, is president and H. M. Washington is secretary of a new farmers' telephone company which has been organized to build a line through Haven, Burrton and Mount Hope.

NASHVILLE, TENN.—A charter has been issued to the Dotson Branch Telephone Company with a capital stock of $250. The incorporators are H. Brimsley, B. D. Welch, J. W. Owens, H. D. Hicks and W. A. Gentry.

LITTLETON, W. VA.—Littleton Telephone Company has been incorporated with a capital stock of $10,000 to operate telephone lines. The incorporators are W. H. Lemley, Rose B. Lemley, J. F. Baker, I. N. Gorby and E. S. Lough, all of Littleton.

TIPTON, IND.—The citizens of Tipton and vicinity have organized a co-operative telephone company. The directors are Jesse F. Mott, Charles Fearnow, John H. Goodnight, Irvin Wheatley, Alpheus Orr, Everett Bunch and Harry Barnett.

SHARPSBURG, PA.—W. B. Clarkson, division manager of the Bell Telephone Company, announces that his company will expend $81,600 in the Sharpsburg and Mount Lebanon districts. Nine miles of overhead wire will be displaced.

COLFAX, WASH.—The Whitman County Telephone & Telegraph Company will commence work immediately on a trunk line to extend from this city to all the principal Whitman County lines for connection with the local exchanges throughout the country.

CENTRALIA, WASH.—The Street Urban Telephone Company has been granted a 25-year franchise to operate in Lewis county. The new line will extend east from Winlock about seven miles. J. T. Lowry is president of the new company and John Christison, secretary.

ROSEBUD, MONT.—The Rosebud Mutual Telephone Company has been incorporated with a capital stock of $5,000 to build a line from Forsyth to Rosebud. The incorporators are John Davidson, Hugh Lynch and Henry W. Bailey, Lee; Alexander McIntosh and Mert Francis, of Forsyth.

ROCK ISLAND, ILL.—The Tri-City Automatic Telephone Company has been incorporated with a capital of $1,000,000. The officers and directors of the new company are Henry C. Struck, Davenport, Iowa; L. S. McCabe, Rock Island; P. H. Wessel, Moline; and Bryan H. Osborne, Franklin, Pa. It is expected that more than $2,000,000 will be expended in building the new plant.

BIRDSBORO, PA.—The Robeson Rural Telephone Company has been organized with a capital stock of $10,000. William H. Bitler is president; A. Samuel Eshelman, treasurer, and E. Carroll Schaeffer, solicitor. The company will operate in the Southern end of Berks County and upon the completion of this line will make extensions to Geigertown, Joanna Heights, Harmony, Church, Coldrun, Morgantown and Elverson.

## ELECTRIC RAILWAYS.

*(Special Correspondence.)*

MISSOULA, MONT.—The right of way has been secured for the Missoula & Hamilton electric road. C.

FAIRFIELD, CAL.—The Vallejo & Northern Railway Company has been granted a franchise to operate a railroad on certain streets of the town.

BELLE FOURCHE, S. D.—Surveys are being made for the proposed electric line to Spearfish, a distance of 10 miles. Fred S. Harris is interested.

GLENDALE, CAL.—E. D. Goode has secured the right of way for the road which he contemplates having built and in operation within four months.

LOUISVILE, KY.—The Louisville & Interurban Railr ad is considering extending its line to Frankfort in one direction, and to Newcastle and Eminence in another.

SPRINGFIELD, MO. — Promoters W. H. Harris and T. B. McDonough, of Chicago, are interested in a proposed electric line to run between Nevada and Springfield.

GADSDEN, IOWA.—Louis Hart has announced that a company has been formed to construct an electric line between Noccalula Falls and Gadsden, and that work will be started at once.

ONTARIO, ORE.—Surveyors are at work for the electric line to be built from Caldwell to Ontario. This will be an extension of the system owned by the Idaho-Oregon Light & Power Company.

CORPUS CHRISTI, TEX.—A movement is on foot in this city, backed by local capital, to build an interurban electric railway line around the Bay front from Corpus Christi to Ward Island.

SALEM, ORE.—The Errol Heights Railway Company has filed articles of incorporation with a capital stock of $20,000 for the purpose of building an extension of the Woodstock branch of the Portland Railway, Light & Power Company's line south to the holdings of the company.

TYLER, TEX.—The construction of an electric street railway system here will soon be started by the Tyler Construction Company, of Dayton, O. The officers of the company are G. A. Dillow, Dayton, president; C. L. Kimmell, first vice-president; J. H. Barkman, second vice-president; E. J. Weaver, secretary; W. P. Perkins, treasurer.

LANCASTER, O.—Treasurer C. M. Rowlee, of the Lancaster & Buckeye Lake Traction Company, has received word that Eastern capitalists are prepared to finance the building of the proposed line between this city and Buckeye. The line will extend from this city through Pleasantville to the Lake. Work is expected to begin soon.

RIVERSIDE, CAL.—Articles of incorporation have been filed by the Riverside-Redlands Interurban Railway Company with a capital stock of $500,000. The directors are William S. Peloubet and Maurice Salx, of Los Angeles, and R. E. Smith, of Riverside. Electric railway lines will be operated in Riverside, Redlands, San Jacinto and Hemet.

PINE BLUFF, ARK.—The Pine Bluff Company has filed articles of incorporation with a capital stock of $1,200,000 for the purpose of operating street railway, electric light and waterworks systems. The incorporators are Henry B. Stillman, Walter Haviland, Henry M. Haviland, Charles M. Lewis, Arthur N. Taylor, William B. White and Smith Weygant.

WILKES BARRE, PA.—Messrs. Graham & Company, New York City, and Bertron, Griscom and Jenkins, Philadelphia, have secured the properties of the traction companies of Montour and Columbia counties, and will expend $300,000 in improving the traction and lighting plants. It is also planned to connect Wilkes Barre with Northumberland by an electric traction line in the near future.

PETALUMA, CAL.—With the object of securing a coast outlet for the Petaluma & Santa Rosa Railway, articles of incorporation have been filed by the Petaluma & Coast Railway, which will run from Liberty, on the line of the former road to Bloomfield, and thence to a point on the Coast near Bodges, a distance of 18 miles. Headquarters will be in this city. The capital stock is given as $250,000, and the directors are J. E. Alexander, B. Levy, A. F. Hoehmer, D. S. Hyde and W. P. Ferguson.

SAN BENITO, TEX.—The San Benito & Rio Grande Valley Railway Company is preparing to begin the construction of an extension of its interurban line from Mission up the valley of the Rio Grande to the coal fields of Zapata County, about 125 miles. The company made a proposition to the people of Rio Grande City to pass through that place for a bonus of $25,000 and free right of way through the town and terminal grounds, which was accepted. S. A. Robertson, of San Benito, is president of the company. D.

## NEW INCORPORATIONS.

CINCINNATI, O.—The Reno-Kaetker Electric Company has been incorporated with a capital stock of $15,000. The incorporators are Frank P. Colville, Henry Kaetker, Stanley Parvin and Lena L. Light.

CHICAGO, ILL.—Baird Equipment Company has been incorporated with a capital stock of $10,000 to deal in electrical goods. The incorporators are Robert C. Wheeler, Cecil Barnes and Charles L. Cobb.

CHICAGO, ILL. — The Cravens Company has been incorporated with a capital stock of $5,000 to deal in electrical devices. The incorporators are George W. Cravens, Ralph Birchard, and William F. Freudenreich.

CLEVELAND, O.—The Electric Goods Company has been incorporated with a capital stock of $10,000. The incorporators are Frank R. Duguny, Earl V. Stacey, Edward Younger, C. C. Corell and L. LaFramboise.

CHICAGO, ILL. — Rex Battery Company has been incorporated with a capital stock of $25,000 for the purpose of manufacturing electrical supplies. The incorporators are William H. Mattern, William W. Congdon, and George W. Ludden.

DAYTON, O.—The Apple Electric Company has been incorporated with a capital stock of $300,000 to manufacture and deal in electrical equipment. The incorporators are V. G. Apple, Oscar Apple, J. C. Slager, Clarence Kiefer and Carl L. Baumann.

CINCINNATI, O.—The Standard Electric Tool Company has been incorporated with a capital stock of $10,000 to engage in the electrical appliance business. The incorporators are Frank H. Kunkel, Earl W. Griffin, Frank P. Hamilton, H. L. Aischolz and Marston Allen.

CLEVELAND, O. — The Rogers Electric Laboratories' Company has been incorporated with a capital stock of $10,000 to deal in electrical machinery and devices. The incorporators are P. C. Greenwell, Walter S. Lister, E. S. Thomas, C. F. Schrod and A. C. Wald.

HOPKINSVILLE, KY.—The M. & M. Meter Box Company has been formed for the purpose of selling meters and other devices used by public service corporations, including electric light, water and gas companies. Thomas W. Morris, John J. Metcalfe and T. L. Metcalfe are the incorporators.

NEW YORK, N. Y.—The firm of Halbert P. Hill, Incorporated, has been incorporated to manufacture electrical machinery, etc. The capital stock is $50,000 and the incorporators are Hakbert P. Hill, Arthur M. Heritage, and Morris W. Atkinson, all of New York City.

WASHINGTON, D. C.—Wedderburn Light Company has been incorporated with a capital stock of $80,000 to engage in the business of electric lighting and the manufacture of gas. The incorporators are C. L. T. Fisher, Bismark Capps, H. G. Elmore, of Lynchburg, Va.; H. C. Cragg and George Wedderburn, Washington.

## FINANCIAL NOTES.

The considerable advances that have been made during the last 30 days in speculative securities is causing some apprehension. Conservative investors are anxious for the market to begin to "act naturally," and the fear is apparently extant that, unless more caution is exercised by the elements now boosting prices, a reaction involving a break in prices will set in.

Primary or fundamental trade conditions are sound, however, and it is generally believed that hard times are now definitely behind, and not before us. Reports from every section of the country and generally reliable indexes all point to a gradual revival of good business with an enhancement of better prices for manufactured articles and a consequent improvement in profits.

The plan for the consolidation of the Havana Electric Railway Company and the Havana Gas Company has been declared operative, a very large majority of the stock of each issue having been deposited. As some of the stock is held in Europe, the time for depositing stock has been extended until April 22.

At the annual stockholders' meeting of the Western Electric Company, U. N. Bethell, vice-president of the American Telephone & Telegraph Company, was elected to the board, succeeding F. R. Welles. Other directors and officers were re-elected.

Applications for the securities of the Tennessee Railway, Light and Power Company, which were offered by H. M. Byllesby & Company, in Chicago, W. P. Bonbright & Company, and Hodenpyle, Hardy & Company, in New York, and E. W. Clark & Company, in Philadelphia, totaled three times the amount offered, it is stated.

Plympton, Gardner & Company, New York City, are offering at eighty-four and interest, to yield five per cent, $1,000,000 first-mortgage four-per-cent gold bonds of the United Electric Company of New Jersey. The bonds are legal investments for Rhode Island savings banks, and are tax exempt in New Jersey. The United Company operates in Northern New Jersey, serving a population of more than 1,000,000.

The Boston Railroad Commission has approved an issue of $754,000 twenty-year, 4.5-per-cent bonds by the West End Street Railway, proceeds to pay in part necessary cost of permanent additions and improvements to property made by Boston Elevated in accordance with terms of issue.

Nelson, Cook & Company, Baltimore, are offering $200,000 Roanoke (Va.) Traction & Light Company first-mortgage and collateral trust five-per-cent gold bonds at ninety-five, netting about 5.3 per cent. This issue will provide for extensions and improvements. Bonds are subject to call at 105 and interest on any interest date.

### Dividends.

American Light & Traction Company, the regular quarterly dividend of 1.5 per cent on the preferred, 2.5 per cent on the common, and 2.5 per cent in common stock on the common stock. The dividends are payable May 1 to stock of record April 16.

Brooklyn City Railroad; a quarterly dividend of two per cent payable April 15, to stock of record April 2.

Commonwealth Edison Company; a quarterly dividend of 1.75 per cent, payable May 1 to stock of record April 15.

Milwaukee Electric Railway & Light Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable April 30 to stock of record April 20.

West Penn Traction Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable April 15 to holders of record April 8.

### Reports of Earnings.

DENVER CITY TRAMWAY.

The Denver City Tramway Company reports for the year ended December 31, 1911, compared as follows:

| | 1911 | 1910 |
|---|---|---|
| Gross | $3,421,854 | $3,595,157 |
| Expenses | 1,734,700 | 1,859,251 |
| Net | 1,687,154 | 1,735,906 |
| Charges and taxes | 1,144,943 | 1,065,833 |
| Surplus | 542,211 | 670,072 |

MEXICAN TELEPHONE & TELEGRAPH.

The Mexican Telephone & Telegraph Compnay reports for the year ended February 29, compared as follows (Mexican currency):

| | 1912 | 1911 |
|---|---|---|
| Gross | $637,069 | $574,420 |
| Operating expenses | 314,453 | 268,274 |
| Net | 322,616 | 306,145 |
| Subscribers | 11,236 | 10,277 |

TRACTIONS EARN MORE IN 1911.

The *Commercial and Financial Chronicle*, in its issue of April 6, presents a compilation of gross and net returns of 257 electric railways for the calendar years 1910 and 1911. Of this number, eighteen roads failed to report net earnings, so that the net figures shown for them are merely an approximation, obtained by taking expenses for the two years at the same ratios to gross earnings as are found in the case of the roads which have furnished reports of both gross and net—roughly, fifty-nine per cent. By this method, the figures are totaled to show complete results as follows:

| | Gross | | |
|---|---|---|---|
| | 1911 | 1910 | Increase |
| 239 roads | $414,928,081 | $380,810,015 | $25,118,066 |
| 18 roads | 13,897,050 | 13,312,111 | 584,939 |
| 257 roads | $428,825,131 | $403,122,126 | $25,703,005 |
| | Net | | |
| | 1911 | 1910 | Increase |
| 239 roads | $170,850,331 | $160,372,546 | $10,477,785 |
| 18 roads | *5,697,790 | *5,457,965 | 239,825 |
| 257 roads | $176,548,121 | $165,830,511 | $10,717,610 |

*Estimated.

On this basis it will be seen that the aggregate net for the 257 roads shows an increase in 1911 of $10,717,610, or 6.46 per cent over the previous year.

REPUBLIC RAILWAY & LIGHT.

The Republic Railway & Light Company's consolidated earnings of subsidiary companies, for the twelve months ended February 29, 1912, compares as follows:

| | 1912 | 1911 |
|---|---|---|
| Gross earnings | $2,410,979 | $2,264,758 |
| Expenses and taxes | 1,429,004 | 1,333,492 |
| Net earnings | 981,974 | 931,266 |
| Interest | 532,984 | 508,569 |
| Surplus | 448,990 | 422,696 |

INTERBOROUGH RAPID TRANSIT COMPANY.

The Interborough Rapid Transit Company reports for eight months ended February 29, 1912, compared as follows:

| | 1912 | 1911 |
|---|---|---|
| Gross operating revenue | $20,321,139 | $19,380,110 |
| Operating expenses | 8,628,380 | 8,043,001 |
| Net operating revenue | 11,692,759 | 11,337,109 |
| Taxes | 1,294,891 | 1,230,319 |
| Income from operation | 10,397,867 | 10,106,790 |
| Other income | 250,365 | 225,611 |
| Total income | 10,648,233 | 10,332,401 |
| Interest, rentals, etc., incl. Manhat. guar. | 7,324,113 | 7,096,980 |
| Net corporate income | 3,324,119 | 3,235,420 |
| Passengers carried | 394,827,692 | 376,070,007 |

HUDSON & MANHATTAN RAILROAD.

The Hudson & Manhattan Railroad Company reports for the month of February compared as follows:

| | 1912 | 1911 |
|---|---|---|
| February gross | $434,322 | $362,271 |
| Net after taxes | 248,815 | 197,923 |
| *Surplus after charges | 7,670 | 152 |

*Interest chargeable to construction is not deducted.

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of February and five months ended February 29, 1912, compares as follows:

| | 1912 | 1911 |
|---|---|---|
| February gross | $ 393,995 | $ 330,737 |
| February net | 123,372 | 103,133 |
| Charges and taxes | 46,941 | 41,974 |
| February surplus | 76,931 | 61,159 |
| Five months gross | 2,105,785 | 1,830,922 |
| Five months net | 807,166 | 694,934 |
| Charges and taxes | 205,781 | 182,783 |
| Five months surplus | 601,385 | 512,151 |

MEXICAN TELEGRAPH.

The Mexican Telegraph Company reports for the year ended December 31, 1911, compared as follows:

| | 1911 | 1910 |
|---|---|---|
| Gross | $ 946,907 | $ 939,109 |
| Expenses and taxes, repairs, etc. | 192,207 | 180,455 |
| Mexican government | 45,500 | 37,772 |
| Surplus | *709,199 | 720,882 |
| Dividends | 358,940 | 358,940 |
| Surplus | 350,259 | 361,941 |
| Previous surplus | 2,585,117 | 2,223,176 |
| Total surplus | 2,935,376 | 2,585,117 |
| Construction account | ..... | ..... |
| Profit and loss surplus | 2,935,376 | 2,585,117 |

*Equal to 19.7 per cent on $3,589,400 capital stock.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

| | April 8. | April 1. |
|---|---|---|
| Allis-Chalmers common (New York) | 2 | 2½ |
| Allis-Chalmers preferred (New York) | 5¾ | 6 |
| American Tel. & Tel. (New York) | 145¾ | 146½ |
| General Electric (New York) | 169½ | 165½ |
| Kings County Electric (New York) | 129 | 129 |
| Postal Telegraph and Cables common (New York) | 81¼ | 80½ |
| Postal Telegraph and Cables preferred (New York) | 69 | 69 |
| Western Union (New York) | 82 | 83½ |
| Westinghouse common (New York) (ex-dividend) | 75½ | 76¼ |
| Westinghouse preferred (New York) | 115 | 122½ |
| Edison Electric Illuminating (Boston) | 292 | 298 |
| Massachusetts Electric common (Boston) | 21⅛ | 21⅝ |
| Massachusetts Electric preferred (Boston) | 94½ | 96¼ |
| New England Telephone (Boston) | 158½ | *160 |
| Electric Company of America (Philadelphia) | 12 | 12 |
| Electric Storage Battery common (Philadelphia) | 55½ | 54½ |
| Electric Storage Battery preferred (Philadelphia) | 55½ | 54½ |
| Philadelphia Electric (Philadelphia) | 18½ | 17 |
| Chicago Telephone, rcps. (Chicago) | *144 | *144 |
| Commonwealth Edison (Chicago) | 146 | 146 |
| National Carbon common (Chicago) | 102½ | 105 |
| National Carbon preferred (Chicago) | 118 | 116¾ |

*Last price quoted.

## PERSONAL MENTION.

J. W. PERRY, manager of the Electrical Department of the H. W. Johns-Manville Company, New York, was among last week's visitors to Chicago.

C. N. JELLIFFE, secretary of the American Light & Traction Company, has been elected treasurer of the company, to succeed J. M. McCarthy, who has resigned.

C. E. MORGAN, for the past four years general manager of the Indianapolis, Crawfordsville & Western Traction Company, Crawfordsville, Ind., has assumed the duties of general superintendent of the Michigan United Traction Company, with headquarters at Jackson, Mich.

F. R. FORTUNE has been appointed to the newly created position of general sales manager of the Cooper Hewitt Electric Company. Burford Britton succeeds him as district sales manager. The headquarters of both officials will be in the Westinghouse Building, Pittsburgh, Pa.

PETER JUNKERSFELD, electrical engineer, Commonwealth Edison Company, Chicago, Ill., delivered on March 29 an address before the students and faculty of the College of Engineering of the University of Illinois on "Engineering and Business Development." Mr. Junkersfeld is a graduate of the University of Illinois, class of 1895.

IRVING P. REYNOLDS, who for 20 years was connected with the Allis-Chalmers Company, holding the position of chief engineer, and who for the past few years has been vice-president and general manager of the William Todd Company, in Youngstown, O., has returned to the engineering department of the Allis-Chalmers Company.

A. S. DUNCAN and A. PODMORE, members of the National Telephone Company's engineering staff, who were transferred to the British Post Office, have been appointed assistant electrician and assistant engineer, respectively, to the Constantinople Telephone Company (Société Anonyme Ottomane des Téléphones de Constantinople), and will shortly proceed to Constantinople to take up their duties.

DANA PIERCE, electrical engineer of the Underwriters' Laboratories, who has been in charge of the principal office in Chicago during the past six years, will on May 1 take charge of the New York offices at 135 William Street. A station for testing electrical appliances will be operated in connection with this New York office, and applications for testing may be made either there or at the original testing station in Chicago.

EDWARD K. PRICE has been appointed advertising manager of the Standard Underground Cable Company, Pittsburgh, Pa. Mr. Price was for a number of years in the publicity department of the Westinghouse Electric & Manufacturing Company, but for the past two years has been engaged in agency work with G. P. Blackiston. Mr. Price is an electrical engineer by profession, which, together with his advertising experience, makes him especially well fitted for his new work.

J. M. SMITH has been appointed manager of the steel-reflector department of the Holophane Company and the Fostoria Glass Specialty Company, which has been purchased and consolidated by the General Electric Company. Mr. Smith was for eight years eastern representative of the Buckeye Electric Company, leaving this organization early in 1910 to become sales manager of the Moline Incandescent Lamp Company, Moline, Ill. He subsequently returned to the Buckeye Electric Company in charge of the industrial-lighting department. Mr. Smith is a pioneer in the application of higher efficiency in the lighting of industrial plants, and his work in the textile mills of the east was a beginning of the revolution which has taken place in the textile and industrial mill lighting. He has made this subject his special study for the past ten years, and his thorough knowledge of the requirements of industrial plants, together with his expert grasp of illumination details, has made him one of the most successful commercial engineers devoted to this branch of the electrical industry.

GEORGE C. RICHARDS has been appointed western manager of the

George C. Richards.

American Circular Loom Company with headquarters at 629 West Jackson Boulevard, Chicago, Ill. Mr. Richards has been associated with the American Circular Loom Company for the past six years, traveling all over the western part of the country, but making his headquarters particularly in that part of the country west of the Mississippi River.

## OBITUARY.

JAMES J. EHRENREICH, an electrical engineer of New York City, died suddenly on April 1 of apoplexy. Mr. Ehrenreich was 33 years of age. He was a graduate of Columbia University, and was a member of several electrical societies.

JAMES P. BLAKE, son of Henry W. Blake, editor of the *Electric Railway Journal*, died on April 1, following an operation at the Manhattan Eye and Ear Infirmary, New York City. He was 16 years of age and a student at Lawrenceville School, N. J.

JAMES SMITH died April 3 in Dalton, Ga. Mr. Smith was for many years a telegrapher for the Associated Press, and his last position was with the New York *World*. He was considered one of the best operators in the business. He had been ill for a month past.

EDWARD H. ANDERSON, of the railway engineering department of the General Electric Company, died at Schenectady, N. Y., March 30. Nearly three years ago Mr. Anderson suffered from paralysis, but unlimited vitality and a strong physique prevailed and he recovered after a few months of rest. He was stricken again on January 4 and the third attack proved fatal within a few days. Mr. Anderson was a well known and talented railway engineer, having had to do with the design and perfection of some of the largest railway systems in this country. He is also credited with a number of important patents relating to improvements in generators, railway motors, controllers, electric brakes, and power-transmission apparatus. He was also known for his electric-automobile controller. Mr. Anderson was born March 17, 1868, in South Carolina. He entered the University of South Carolina and was graduated with honors. He went to Schenectady in 1895, entering the testing department. In a few years he was made designing engineer in the railroad department. This position he held until his death. In 1896 he married Miss Mary E. Anderson. He was a member of the Mohawk Club, the Sigma Nu fraternity and an associate of the American Institute of Electrical Engineers.

## DATES AHEAD.

Nebraska Electrical Association. Annual convention, Omaha, Neb., April 16-18.

American Institute of Electrical Engineers. Pacific Coast meeting, Portland, Ore., April 16-20.

American Electrochemical Society, Twenty-first general meeting, Boston, Mass., April 18-20.

Iowa Electrical Association. Annual meeting, Des Moines, April 24-25.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, April 25-26.

Association of Iron and Steel Electrical Engineers—American Institute of Electrical Engineers. Joint meeting, Pittsburgh, Pa., April 25-27.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

American Institute of Electrical Engineers. Schenectady, N. Y., May 17.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

Mississippi Electric Association. Fourth annual convention, Vicksburg, Miss., May 28-30.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Minnesota Electrical Contractors' Association. Annual convention, Duluth, Minn., June 16.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic* sailing from Port Huron, Mich., on June 21.

Society for the Promotion of Engineering Education. Annual meeting, Boston, Mass., June 25-27.

American Institute of Electrical En-

gineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 16-19.

Ohio Electric Light Association. Annual convention, The Breakers, Cedar Point, O., July 17-19.

The 1912 Boston Electric Show, Mechanics' Building, Boston, Mass., September 28-October 26.

American Electric Railway Association. Annual convention, Chicago, Ill., October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

# With the Electrical Manufacturers

**Thompson-Levering Company,** 244 Arch Street, Philadelphia, Pa., has issued a folder calling attention to the advantages of its testing sets. These are supplied in both the switch-dial and plug types, and are supplied with a quick-acting, high-sensibility, dead-beat galvanometer.

**The Clapp-Eastham Company,** 139 Main Street, Cambridge, Mass., has issued its catalog M devoted to wireless telegraph apparatus. Among the apparatus illustrated and described are wireless transformers, antenna switches, keys, oscillation transformers and helices, spark gaps, condensers, timers, detectors, receiving and transmitting sets.

**The Lindsay Brothers Company,** of Spokane, Wash., has sent out folders showing some fine illustrations of the use of 45-foot Western cedar poles in the 86-mile transmission line of the Butte Electric & Power Company, between Big Timber and Billings, Mont. The advantages of these poles over steel towers are pointed out; briefly these are low original cost and maintenance, increased life when treated cedar poles are used, relative freedom from lightning and trespassers.

**The Peterson Engineering Company,** 50 Church street, New York City, has published a circular describing its Economy elevator-guide lubricator for use with all sizes and types of cars. It was designed after careful study of the requirements and has been found not only very effective but highly economical in service. These lubricators employ grease and have standard attachments for any ordinary type of elevator. They have been extensively employed in government buildings after severe tests.

**The De Laval Steam Turbine Company,** Trenton, N. J., has published catalog D devoted to multi-stage De Laval steam turbines. This is a 117-page publication which describes and illustrates every part of the turbine, explains the operation of the different types of turbines and their adaptation to various kinds of service, including the relatively slow-speed driving of direct-current generators through the De Laval helical reduction gear. Many valuable data and suggestions are included in this catalog.

**The H. W. Johns-Manville Company,** New York, N. Y., has published a new catalog (No. 112) devoted to J-M sectional conduit for insulating pipes conveying steam, water, gas or liquids underground. This catalog comprises 44 pages and is artistically prepared. The construction of the conduit is described in detail, test results, specifications and valuable data are given, and many installations listed and illustrated. The concluding pages of the catalog are devoted to J-M fiber electric conduit.

**The Electrose Manufacturing Company,** Brooklyn, N. Y., has opened its new manufacturing plant, which is located in the Robert Gair Building adjacent to the Brooklyn Bridge. The new factory, when fully completed, will be about 50 per cent larger than the former plant, which was destroyed by fire about three months ago. The present facilities permit of both day and night operation and will enable the company to catch up in a short time with the business which it lost since the destruction of the old plant. The factory is now housed in one of the most approved fireproof structures in the country. Its electric, steam and water supplies are unsurpassed and the new equipment places the company in a position to make prompt deliveries on orders for all kinds of insulators from 1,000 to 1,000,000 volts.

**The Electric Storage Battery Company,** Philadelphia, Pa., has published a 40-page booklet of much value to central stations throughout the country. It is entitled "A Central-Station Prophecy Fulfilled," and points out in a very pretty and effective manner the value of electric-vehicle charging in filling out the deep valley in the load curve between midnight and about 7 a. m. There is probably no off-peak load that can be obtained as readily as the electric-vehicle load. There were nearly as many electric vehicles sold last year as many former years put together. The sales this year will doubtless greatly exceed those of 1911. All these facts are clearly pointed out in the booklet, also the importance of having a dependable storage battery in all electric vehicles. About half of the booklet is devoted to announcements of 22 electric-vehicle manufacurers. Copies of this publication may be obtained by those interested in the development of the central-station and electric-vehicle industries.

**The General Electric Company,** Schenectady, N. Y., has just issued a number of important publications. Of these doubtless the most striking is bulletin No. 4921, which is devoted to electric heating and cooking appliances. This bulletin is in many respects a work of art. It is printed in two colors on heavy coated stock and has an attractive embossed cover. It abounds in fine illustrations of various heating appliances and their use in the home, office and factory. There is also contained a section devoted to wiring plans and convenient wiring devices for use in the home. Bulletin 4928 is devoted to searchlight projectors for commercial use. It describes not only the carbon-arc projectors, for which the company is noted, but contains also illustrations and descriptions of a new type of incandescent-lamp searchlights. This bulletin should prove of interest to yacht and motor-boat owners. Bulletin No. 4929 treats of the application of electric motors to the operation of brick plants. The bulletin shows how the motor can be used to advantage in the various operations of brick machinery. It also contains a copiously illustrated description of a typical electrically operated plant and gives valuable data relative to the cost of operation in this industry. Bulletin No. 4940 illustrates and describes the company's latest developments in the commutating-pole motor, known as the type DCL.

**The Westinghouse Electric & Manufacturing Company,** East Pittsburgh, Pa., has issued a number of new publications of general interest to electrical men. Descriptive leaflet 2441 is devoted to important features in the application of small motors. Leaflet 2443 illustrates and describes the use of direct-current series and wound-rotor induction motors for crane and hoist service. Leaflet 2409 covers self-starting synchronous motors from 90 to 1,500 horsepower and operating at 200 to 6,600 volts. Leaflet 2362 describes small single-phase motors of less than one-horsepower rating and intended for light domestic and office use. Leaflet 2446 treats of electrically operated brakes for direct-current crane and hoist motors. Leaflet 2449 describes hand-operated controllers for light crane and hoist service requiring less than 7.5 horsepower. Leaflet 2447 is devoted to electrically operated brakes for mill and crane motors performing heavy service. Leaflet 2383 describes alternating-current steel-mill motors for very severe service. Circular 1088 treats of three-wire direct-current generators. Folder 4049 describes carbon circuit-breakers for lighting circuits and small motors. Circular 1522 deals with multiple-unit trains and HL control; it describes the many advantages of this type of multiple-unit control and contains reprints of two papers on the subject presented at recent electric-railway conventions.

# Record of Electrical Patents.

## Issued by the United States Patent Office, April 2, 1912.

**1,021,774. Regulation of Electric Circuits.** M. Guett, assignor to Hart & Hegeman Manufacturing Co., Hartford, Conn. A double-pole rotary snap switch with a third auxiliary bridging member.

**1,021,787. Electrical Apparatus for Stage Effects.** A. L. McMurtry, Sound Beach, Conn. A dancer carries a battery and induction coil to whose secondary several spark gaps are connected. A switch for the primary circuit is mounted on the shoe.

**1,021,831. Cross-Arm for Telephone or Telegraph Poles.** J. R. Ferringer, Emlenton, Pa. Is made of reinforced plastic material.

**1,021,857. Overhead-Trolley Switch.** E. H. Anderson, Indianapolis, Ind., assignor of one-half to F. M. Timmins. Includes a continuous main wire, a siding wire and a pull-over device.

**1,021,859. Primary Battery.** W. A. F. Bleeck, Brisbane, Queensland, Australia. A two-fluid battery with zinc in caustic soda solution and a depolarizer comprising chromic and hydrochloric acids and ferrous and nickel sulphates.

**1,021,881. Electrical Interrupter Device.** C. H. North, assignor to North Electric Co., Cleveland, O. Relates to the construction of the armature for an electromagnetic vibratory interrupter.

**1,021,900. Storage Battery.** J. L. Smith, Detroit, Mich. Includes end and intermediate spacing frames and support sheets interlocked to form a liquid holder with several cell compartments.

**1,021,907. Apparatus for Preventing Sparking at the Contacts of Electrically Illuminated Signs.** R. F. Venner, Addiscombe, England. A switch is given a quick-make and quick-break movement by means of a cam and spring associated with a rotary shaft.

**1,021,920. Telephone Receiver.** W. W. Dean, assignor to Dean Electric Co., Elyria, O. The casing is made of thin sheet metal within which is an insulating lining.

**1,021,942. Printer for Multiplex Printing-Telegraph Systems.** D. Murray, London, Eng. Includes a typewriter, a selecting mechanism and telegraphic control circuits for each.

**1,021,974. Portable Electric Heater.** F. L. Dyer, Montclair, N. J. Includes a water-immersion heating coil and a casing for holding the coil and connections when not in use.

**1,021,989. Storage-Battery Electrode and Process of Making It.** W. Morrison, Des Moines, Ia. Comprises a tube of active material, a porous envelope inclosing the same, and a strip of wire gauze helically wound on the envelope.

**1,021,990, 1,021,991 and 1,021,992. Binder for Peroxide Active Material and Process of Making It.** W. Morrison, Des Moines, Ia. In the first of these patents tungsten is included in the binder compound; in the second tantalum, and in the third niobium.

**1,021,993 to 1,021,996, inclusive. Process of Binding the Active Material of Positive-Pole Lead Electrodes.** W. Morrison, Des Moines, Ia. The first two of these patents describe two methods of impregnating peroxide of lead with a tungsten compound. The third patent relates to the impregnation with a tantalum compound, and the fourth to a similar process with a niobium compound.

**1,021,997. Storage-Battery Conductor or Support.** W. Morrison, Des Moines, Ia. Consists of lead, a member of the periodic sulphur group having an atomic weight higher than that of sulphur, and antimony.

**1,022,000. Electropneumatic Tool.** A. Palmros, assignor to Pneumelectric Machine Co., Syracuse, N. Y. A reciprocating tool operated by a compact motor-driven air-compressing mechanism.

**1,022,001. Electrically Controlled Brake.** E. Price, assignor to General Electric Co. A motor-driven hoist has a separate motor and electrical device for releasing the brake.

**1,022,009. Electric Arc Lamp.** E. Weintraub, assignor to General Electric Co. A mercury-vapor lamp has its electrodes in contact when cold and drawn apart as soon as the circuit is closed.

**1,022,010. Vapor Electric Device.** E. Weintraub, assignor to General Electric Co. Above the surface of the mercury in the rectifier tube is an amalgamated copper block to absorb and dissipate heat.

**1,022,012. Purification of Gases.** W R. Whitney, assignor to General Electric Co. Sulphur dioxide is removed from gas by introducing steam and nitric acid to form sulphuric acid which is deposited by being passed between high-potential electrodes.

**1,022,016. Electric Heater.** W. S. Andrews, assignor to General Electric Co. A flatiron has a normally open switch, manual means for closing it, thermostatic means for opening it and preventing its closure until the iron cools to a definite temperature.

**1,022,021. Space Block.** E. H. Farquhar, assignor to General Electric Co. Has raised ribs to afford ventilating space between the core laminations of a dynamo-electric machine.

**1,022,023. Dynamo-Electric Machine.** W. J. Foster, assignor to General Electric Co. Ventilating space blocks with partly radial, partly circumferential and partly angular ribs are provided in the rotor laminations.

**1,022,025. Machine for Forming and Electrically Welding Tubes.** E. J. Guay, assignor to General Electric Co. A sheet-metal blank is wrapped about a mandrel and a welding wheel, to which electric current is applied, is passed over the joint.

**1,022,026. Insulator.** J. A. Guthrie, assignor to Guthrie-Mitchell Co., Little Rock, Ark. Consists of frustoconical mating halves held by a clamping set and U-shaped key.

**1,022,029. Motor-Control System.** K. F. Kingwell, assignor to General Electric Co. Automatic control for a motor-driven pump which starts and stops the motor when the tank level reaches definite limits.

**1,022,032. Feed Regulator for Heating Systems.** H. Lemp, assignor to General Electric Co. Control for the motor that drives the fuel-oil pump and boiler-feed pump is dependent on the steam pressure.

**1,022,033. Means for Handling Freight.** S. H. Libby, assignor to General Electric Co. A motor-driven hoisting platform auxiliary to an electric traveling crane.

**1,022,039. Blue-Printing Machine.** F. F. Metzger, assignor to Williams, Brown & Earle, Inc., Philadelphia, Pa. Has means for adjusting the position of the arc lamps.

**1,022,049. Electric Switch.** G. B. Reisbach, Milwaukee, Wis. Is provided with a magnetic blowout attachment.

**1,022,057. Incandescent Electric Lighting.** W. L. Bliss, Brooklyn, N. Y. The lamp socket contains a polarized relay for connecting two of the three lamp contacts when the current flows in one direction.

**1,022,058. Electrical Apparatus.** W. L. Bliss, Brooklyn, N. Y. An incandescent lamp with a small and a large filament, each having one terminal independent and one terminal in common.

**1,022,061. Electrically Heated Branding-Head.** E. N. Chandler, assignor to Simplex Electric Heating Co., Boston, Mass. Has a resistance element adjacent to a die.

**1,022,065. Ringer.** W. W. Dean, assignor to Dean Electric Co., Elyria, O. An electromagnetically vibrated telephone bell.

**1,022,072 and 1,022,073. Portable Electric Lamp.** E. Gottschalck, assignor to Electric Export-Werke G. M. B. H., Berlin, Germany. Mounted in a carrying case is a set of batteries, a miniature lamp and reflector, together with means for breaking the circuit if the reflector becomes broken.

**1,022,083. Bowling Alley.** F. C. Hobbs, assignor to Brunswick-Balke-Collender Co., New York, N. Y. Has an electrically operated centering device and indicator for each pin.

**1,022,121. Insulator Pin.** C. J. Boyland, Indianapolis, Ind. Consists of a sheet-metal shell logitudinally slotted the whole length.

**1,022,143. Suspension Device for Trolley Wires.** E. Kindler, Fridenau-Berlin, Germany. The block has a tapered undercut groove and wedge to engage the wire.

**1,022,144. Trolley.** H. A. Krause, Philadelphia, Pa. Has guard disks on each side of the trolley*wheel.

**1,022,161. Means of Fastening Electric Conductors to Insulators.** J. S. Thompson, Mill Valley, Cal. On each side of the central connector is a clamping part, all being held by one bolt.

**1,022,175. Telephone.** R. A. Boniventure, New York, N. Y. A desk set

with a special arm for holding the receiver to the ear.

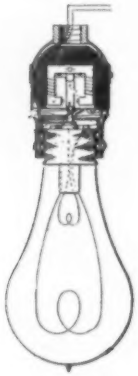
**1,022,182. Method of Wire-Drawing.** J. T. H. Dempster, assignor to General Electric Co. A method of drawing tungsten wire consists in applying to the wire an adherent graphite coating by highly heating graphite while in contact with the wire and then passing the wire through the die.

**1,022,189. Remote Temperature Control.** H. G. Geissinger, assignor to Geissinger Regulator Co., New York, N. Y. A therostat electrically controls a relay for actuating a regulating valve.

**1,022,192. Attachment to Spark Plugs.** H. C. Hemmeter, Pontiac, Mich., assignor of one-half to C. C. Van Wagoner. Has a glass tube around the electrode regulator.

**1,022,226. Cable Hanger.** J. Davis, Aurora, Ill. Is made of a metal band bent to form a close loop about the cable and terminating in nested hooks on the messenger strand.

**1,022,231. Mold for Bases for Telephone and Other Poles.** J. A. Garey, Mound City, Mo. For making a reinforced-concrete pole.



1,022,057—Relay Lamp Switch.

**1,022,234. Shade-Holder.** G. W. Goodridge, assignor to Bryant Electric Co. Has lower and upper abutment rings that are screwed together to engage the supporting bead on the socket.

**1,022,241. Current Interrupter and Distributer for Electrical Ignition Apparatus.** G. Honold, assignor to R. Bosch, Stuttgart, Germany. Included in a housing are a cam, a contact brush, a distributer plate and a set of contacts engaged by the brush.

**1,022,252. Telephone Transmitter.** M. Moloney, Christchurch, New Zealand. Comprises a set of carbon elements, including pencils, a center stud, washers, pellets, granulated carbon and a carbon disk.

**1,022,255. Dynamo-Electric Machinery.** C. A. Parsons and A. H. Law, Newcastle-upon-Tyne, England; said Law assignor to said Parsons. The core slots are triangular, with a greater width at the base than at the periphery.

**1,022,276. Primary Battery.** Z. Szpor, Stanislawow, Austria-Hungary. A muff-shaped porous jar separates the inner electrolyte from the outer depolarizing solution.

**1,022,310. Pressure-Gage.** C. O. Everhart, Warren, Pa., assignor of one-half to A. Miles. Includes an electric high-pressure and low-pressure alarm.

**1,022,324. Controlling System for Motor Traction Cars.** W. C. Mayo, El Paso, Tex., assignor of one-third to G. E. Briggs, and one-third to J. Houlehan. Controls the motors and also the various positions of the triple valve for the air brakes.

**1,022,328. Electric-Lamp Bracket and Socket.** E. L. Partridge, assignor to Adams & Westlake Co., Chicago, Ill. Is mounted on a tongue extended from the base.

**1,022,329. Fuse.** F. P. Poole and P. A. Brendel, assignors to Bryant Electric Co., Bridgeport, Conn. A plug fuse with a central barrier forming two fuse chambers.

**1,022,333. Armored Tire.** V. A. Rouilliard, Fall River, Mass., assignor of one-half to A. L. Audet. A rubber tire comprising one or more layers and a protecting metallic coat electrodeposited on one of them.

**1,022,350. Telephone.** C. C. Blackham, Bridgeport, Conn. A combined transmitter and receiver arm is pivoted to a desk standard.

**1,022,355. Protecting Means for Electrical Distribution Systems.** G. A. Burnham, assignor to S. B. Condit, Jr., Boston, Mass. Provides an overload circuit-breaker at each substation operated by local tripping magnets but controlled by a locking means at the next substation so as to permit only that circuit-breaker nearest the trouble to open.

1,022,329.—Plug Fuse.

**1,022,357. Electric Trolley.** L. M. Davis, Portland, Ore. Relates to the construction of the harp.

**1,022,374. Trolley Wheel for Electric Cars.** J. C. Eames, San Francisco, Cal. Comprises a frame made of two disks of sheet metal.

### Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 9, 1912:

536,996. Electrode. H. T. Barnett, London, England.

537,006. Electric-Bath Metal-Heating Apparatus. G. D. Burton, Boston, and E. E. Angell, Somerville, Mass.

537,012. Electrical Welding Apparatus. G. D. Burton and E. E. Angell.

537,009. Method of and Apparatus for Electrical Metal Heating. G. D. Burton and E. E. Angell.

537,010. Ventilating Apparatus for Dynamo-Electric Machines. G. D. Burton and E. E. Angell.

537,011. Electric-Bath Metal-Heating Apparatus. G. D. Burton and E. E. Angell.

537,013. Apparatus for Brazing Metals by Electricity. G. D. Burton and E. E. Angell.

537,014. Machine for Closing Ends of Tubes. G. D. Burton and E. E. Angell.

537,032. Electric Clock. F. L. Gregory, Chicago, Ill.

537,058. Incandescent Lamp. C. A. Merritt, Birmingham, Ala.

537,078. Means for Increasing Locomotive Traction. C. Selden, Baltimore, Md.

537,118. Electrical Indicator. E. H. Johnson, New York, N. Y.

537,124. Electrical Steering Gear. R. Noury, Nouveau Phalere, Greece.

537,130. Arc-Rupturing Device. E. A. Sperry, Cleveland, O.

537,133. Electric Railway-Signal Apparatus. G. L. Thomas, Brooklyn, N. Y.

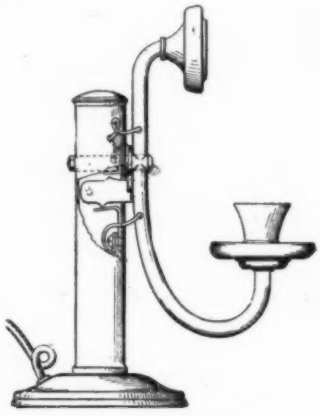
537,149. Demagnetizer. E. F. Gooding and G. W. Scovil, Elgin, Ill.

537,161. Police-Signaling Apparatus. W. H. Kirnan, Bayonne, N. J.

537,194, and 537,195. Conduit Electric Railway. J. H. Guest, Boston, Mass.

537,196 and 537,197. Supply System for Electric Railways. J. H. Guest.

537,198. Electric Railway. J. H. Guest.



1,022,350.—Desk Telephone.

537,199. Electric-Railway Supply System. J. H. Guest.

537,200. Closed-Conduit Electric Railway. J. H. Guest.

537,238. Method of and Apparatus for Making Conduit Sections. A. Segade and D. J. O'Regan, Detroit, Mich.

537,242. Pyrometer. A. A. Simonds, Dayton, O.

537,259. Non-Arcing Switch. A. Wurts, Pittsburgh, Pa.

537,271. Incandescent-Lamp Base. W. C. Bryant, Bridgeport, Conn.

537,282. Telephony. E. F. Frost, Washington, D. C.

537,343. Electrical Measuring Instrument. E. Hartmann and W. Braun, Bockenheim, Germany.

537,358. Electric Battery System. A. J. Powell and W. H. Hall, Brooklyn, N. Y.

537,402. Electric-Bath Metal-Heating Apparatus. G. D. Burton, Boston, and E. E. Angell, Somerville, Mass.

537,404 and 537,405. Apparatus for Electrically Heating Metal. G. D. Burton, Boston, Mass.

537,412. Rheostat. J. C. Fyfe, Chicago, Ill.

537,414. Closed-Conduit Electric Railway. J. H. Guest, Boston, Mass.

537,415. Supply System for Electric Railways. J. H. Guest, Boston, Mass.